TECHNOLOGY TRANSFER IN PACIFIC ECONOMIC DEVELOPMENT

Papers and Proceedings of
The Sixth Pacific Trade and Development Conference
held by
National Science and Technology Council
in Mexico City, July 1974

Edited by
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Center Paper No. 25

January, 1975

THE JAPAN ECONOMIC RESEARCH CENTER
TOKYO

PREFACE

The Sixth Pacific Trade and Development Conference was held in Mexico City from 15 to 20 July, 1974 to search for a new objective for the conference series. The first conference in this series was held in Tokyo in January 1968; the second in Hawaii in January 1969; the third in Sydney in August 1970; the fourth in Ottawa in October 1971; and the fifth again in Tokyo in January 1973. The conference started with a very simple premise. That is we people in the extended Pacific area, including Latin America and Asian developing countries, should pay keen attention to economic development and trade expansion among our neighbours who have huge potential for future development. This potential has tended to be neglected in the past. Fortunately, since our conference series started, the Pacific trade and development studies have established their influence upon trade and development policies in the Pacific-Latin American-Asian region.

We held this year's Conference for the first time outside the more advanced Pacific countries, in Mexico City, one of the most thriving centers in the less industrially developed nations. The Pacific trade and development studies have always to search for a new direction, especially in the present uncertainties in the international monetary and trading system after the oil crisis. The new direction should be the acceleration of modernization and industrialization of developing economies, including the oil producing areas. Technology transfer, foreign direct investment, trade, and even oil money will play a critical role if they are utilized appropriately. This book contains the papers and proceedings of the Sixth Conference, discussion at which focussed on those important issues.

"The role of technology transfer in Pacific economic development," the theme we chose for the Mexican conference, was a topic of wide interest in Latin America and a large number of experts participated in the conference from various parts of that region. Unfortunately the book was not able to include two or three papers for either they were written in Spanish or not presented to but came after the conference. Also we missed comments from some papers, and the summary of discussion for all papers mainly due to language difficulties. We have to apologize to those contributors. However, all of them will be taken up in a Spanish-language version of this book which will be published somewhat later by the Mexican Organizing Committee.

Finally, we are deeply grateful to all the participants, Consejo Nacional de Ciencia y Tecnologia and El Colegio de Mexico who made possible the success of the conference. We are also indebted to the Government and business circles in Mexico and the Asia Foundation for their financial support to the conference.

January 1975

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PREFACE

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COMMUNIQUE

The Sixth Pacific Trade and Development Conference has just concluded in Mexico City after one week of meetings (July 15-20, 1974). This Conference was attended by economists from the developed and the developing countries of Asia and Latin America interested in the problems and policies of Pacific area countries.

This was the first Pacific Conference held in Latin America and indeed, the first held in one of the less industrially developed nations.

The host institutions for this Conference were the Consejo Nacional de Ciencia y Tencnologia and the Colegio de Mexico. Participants included a number of scholars associated with these and other Mexican Institutions and from elsewhere in Latin America. For the first time, two economists from the Soviet Union participated in the Conference. Other participants were from the Andean Group, Australia, Brazil, Canada, Japan, Republic of Korea, New Zealand, Thailand and the United States.

The main theme of the Conference was the transfer of technology, particularly between developed and developing countries of the Pacific Region, and the technology needs of that second group. It was emphasized that technology is very heterogeneous and that it affects patterns and processes of both production and consumption. Among the factors involved in transfer of technology, major attention was paid to the impact of multinational corporations, trade in capital goods, technical assistance and the impact on technological development of domestic economic policies in respect to tariffs, incentives, patents and trademarks, and related technological policies including the screening of technological agreements in the importing countries.

Participants discussed the experience of some developing countries of Asia and Latin America in acquiring and adapting technology in such widely varied industries as agriculture, fishing and fish processing, chemicals, capital goods and various consumer goods.

Policy views on which there was wide agreement included:

1. The necessity of reconciling and liberalizing protective trade measures, especially when these have the effects of segregating national markets and facilitating the concentration of market power (by multinational and other enterprises), thus making it more difficult to establish markets of magnitude that would permit developing more distinctive adaptations of production technology and consumer goods.

2. The desirability of providing developing country producers with a wider choice among technologies available in the international markets, through better information on available products and processes, and through the strengthening of indigenous R-D institutions including those providing technical training, engineering skills and industrial research capability.

The proceedings of the Sixth Pacific Conference will be published in Spanish and English later this year.

The Seventh Pacific Trade and Development Conference will be held in Auckland, New Zealand, in August 1975.

July 20, 1974
Mexico City

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PART I

THE CONTEXT OF INTERNATIONAL RELATIONS IN THE PACIFIC REGION AS IT AFFECTS DEVELOPMENT TRADE AND TECHNOLOGY

1

THE GEOPOLITICAL AND ECONOMICAL FRAMEWORK OF THE TRANSFERENCE OF TECHNOLOGY IN THE PACIFIC BASIN: LATIN AMERICAN VIEWPOINT

OMAR MARTÍNEZ LEGORRETA

The Pacific Ocean, largest in the world, occupies an area greater than all of the land masses together. Nearly half of the world population lives in countries with coasts on the Pacific, including the two military superpowers (the United States and USSR), the most populated nation (China), the one with the fastest economical growth (Japan) and two intermediate powers with a great future ahead of them (Canada and Australia). In the Pacific there are also twenty-six states in various stages of development: most of them in Southeast Asia and many in Latin America.

A variety of systems coexist in the Pacific Basin: capitalist and socialist nations, authoritarian and democratic systems, centralized economies, mixed or free enterprises, civil and military governments, and institutional and pretorial systems. This variety, besides making any attempt of a global analysis very difficult, is responsible for the Basin being considered until today as a geopolitical concept rather than a political-economic reality; a reality which, on the other hand, is within a world context of complex power struggles.

The decade of the seventies is witness to an agile readjustment of international politics:

a) The tensions that characterized the previous decade are diluted; tensions which were mostly due to the profound irreducibility of principles which underlay the world's ideological frontiers between socialist and capitalist fields.

b) These frontiers of political bipolarism are being broken, and an experiment in multipolarism, which will ideally lead to universalism, is in process.

c) Parallel to the spread of multipolarity (identified with the United States and the USSR, Japan, China and the European Economical Community) the countries in development tend to regional integration (Arab world, Latin American Community, etc.).

The new scheme has its roots in the economic and political phenomena of horizontal tensions (at the level of power relationship) and vertical ones (at the level of relations between poor and rich countries). Among these phenomena the most important are:

a) The restriction of economic and commercial interchange within the artificial limits of a world ideologically split in two.

b) The imminent danger of a nuclear conflagration of very high human and economic costs between the two superpowers, as a result of

maintaining ideological rigidity.

c) The emergence in the developing countries of a national awareness of the necessity for economic independence as a complement of political independence.

d) The growing politization and fragmentation of the so-called Third World, to cover a wide range of positions ranging from the radical point of view to the most diluted neutralism.

e) The consciousness of the vital interdependence between the economies of the industrialized countries and those of the developing countries, heightened by the world fuel crisis, the scarceness of raw materials, the population explosion and environmental pollution.

In definite terms, the new scheme is operating against a background of such events as the approachment between the United States and China and between the United States and the USSR, the preliminary talks in Vienna to reduce the contingents of OTAN and of the Warsaw agreement, the first results of the SALT talks related to the limiting of nuclear weapons on the two superpowers, the Paris agreements on Vietnam, the Arab-Israeli negotiations, the lessening of the conflict between both Germanies, the Pan-European conference, the Nixon doctrine for Southeast Asia, the Russian proposition of opening frontiers to the World based on the Brezhnev doctrine, the Chinese diplomacy for the Third World based on the Five Principles of Pacific Coexistence, the "economic diplomacy" of Japan, the Third UNCTAD, the conferences of Non-aligned Countries, and so on.

Nevertheless, although the forces of the world economy have been important in this trend of international politics, the signs are less clear in the field of economic and financial transactions. Monetary crises follow one after the other; the inflation process covers all regions of the capitalist world and undermines its transactions with planned economies. The consolidation of transnational firms makes the main centers of political power feel that their decision possibilities are restricted by those invisible superstates. They rebel against the ministers of finance in Washington, Tokyo or Bonn, surprising the Group of Twenty in the International Monetary Fund or the executives of the Common Market and are even able to manipulate the precarious economic and political balance of many underdeveloped countries.

The presence of four world powers in the Pacific Basin has motivated the operation of new world diplomacy in the zone, and the indirect effect of others is being felt in the countries of the Basin. Nevertheless, it is important to point out that the strategic weighting here of USA-USSR-JAPAN-CHINA does not necessarily correspond that of any other area in military and economic aspects. Here, the military power of the Pacific Basin is concentrated overwhelmingly in the United States.

We only need to remember its bases and military installations in Asia, the American alliances with Japan and the Southeast Asian countries, the Inter-American Treaty of Reciprocal Assistance, the Seventh Fleet and the control over the Panama Canal. The Soviet Union presence is felt with its naval base in Vladivostok and with hundreds of submarines and other ships operating in the area, but the specific weight of this military presence is still far from that of the United States. This fact, combined with the uncertain frontier resulting from the Sino-Soviet conflict, reduces the significance of the USSR as a power in the Pacific Ocean.

Postwar Japan has become the first case in history of an economic power without war power also. This political "schizophrenia" is reflected in the almost exclusive orientation of Japanese diplomacy towards commercial and financial problems. Although the controversy

of rearming Japan is beginning to have importance in relations with the United States, China and the USSR, it can be foretold that in the near future Japan will not become a military power.

The economic balance between the four powers of the Basin is also almost impossible. Because of their socio-economic structure, the two commercial and financial giants are the United States and Japan.

In this sense, the USSR is still a European power, remote from the Pacific. China, whose reason for being among the world powers is due to the future projection of its growing economy and population volume, is still far from making its presence felt in the Pacific Basin in economic and financial transactions.1)

According to foreign trade information for 1970, the Pacific Basin contributed 41 percent of total world exports, 40.6 percent of imports and 40.8 percent of total world trade. In other words, transactions with a total value of 234 thousand million dollars. The developed areas of the Basin (United States, Japan, Australia, New Zealand and Canada) participated with 31.2 percent of world exports, 29.7 percent of imports and 30.4 percent of international trade. The developing nations of the Asiatic-American basin contributed 9.8 percent of exports, 10.9 percent of imports and 10.4 percent of world trade.2)

The United States led the international trade of the Basin, with 15.5 percent, 15.9 and 15 percent of the exports, imports and total trade respectively. Japan followed with 6.9 percent, 6.4 percent and 6.6 percent, respectively.

This active participation of the United States and Japan is reflected in the high level of dependence that other Basin countries have in their trade with these two countries. Eighty-five percent of Canada's foreign trade, 80 percent of Mexico, 65 percent of the Andes Group, 38 percent of Australia and Central America and 29 percent of Southeast Asia's trade was done with the United States. Regarding Japan, the order of dependence of transactions of other countries in this regard was as follows: Southeast Asia 42 percent, Australia 37 percent, and Andes Group with 11 percent.

No less intense is the dependence of the Basin's countries on investment of American and Japanese capital. Of approximately 2,000 million dollars that Japan had invested in the world between 1951 and 1968, 340 million were located in Southeast Asia. Of these 34 percent was in mining and 8 percent in the exploration of natural resources with the well defined purpose of assuring supply of raw materials.

Seventy-one million dollars were oriented towards manufacturing investment, with the textile industry at the head. This meant the transfer to Southeast Asia of those weaker industrial sectors of the industrial structure of Japan, due to the relatively slow technological development of the textile industry, the lack of adjustment of organizational structure (medium and small firms) and the exploiting of cheap non-specialized manpower.3) In Latin America U. S. in-

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1) It should be pointed out that in the souhtern and south-eastern region of Asia (limited to Malaysia, Pakistan, Ceylon, Singapore and Hong Kong) China has had a trade surplus that reached 890 million dollars in 1969. (JETRO, How to approach the China Market, Tokyo 1972. Japan Institute of International Affairs, White Papers of Japan, 1969-1970; 1970-1971, Tokyo 1972.)

2) The figures of foreign trade and of the Basin are from information that appeared in the International Monetary Fund, Direction of trade, Annual 1966-70; United Nations Monthly Bulletin of Statistics, November 1972; see appendices 1 to 5 in this work.

vestments are over 17 thousand million dollars. The area's debt with the United States is increasing and the political tendency of the hemisphere is clearly anti-American.[4]

In view of the dominance of the United States and Japan in the trade area what degree of cohesion and dynamism do figures on foreign trade reveal among the subregional groups of the Basin? On the basis of data from 1970, the Central American Community circulated 688 million dollars in its trade between the six countries of the community, which corresponds to 19.4 percent of Central America's foreign trade. The eight countries of Southeast Asia, plus South Korea, Taiwan and Hong Kong circulated 1,800 million dollars in their intraregional trade, or 5.5 percent of their total trade. Seven countries of the Andes Group interchanged 305 million dollars or 2.01 percent of their foreign trade. To sum up, on the American coast of the Pacific the least integrated and the most integrated sub-regions of the Basin are simultaneously located here: Andes Group and Central America, respectively.[5]

These low figures of interregional trade, apart from the United States and Japan, as well as the overwhelming presence of these two economic powers in commercial transactions and capital investment, suggest the urgency of finding new approaches to the economic relations prevailing in the Pacific Basin, oriented towards lessening this accentuated bipolar dependence.

On the other hand, the low levels of trade carried out in the subregions indicate that projects of subregional integration have not diminished the polar attraction exerted by the United States and Japan to a desirable extent. We should wonder if these projects are not creating a better structuring of the subregional communication mechanisms benefiting ultimately the two commercial superpowers.

In any case, it seems to be evident that, in terms of the new trends of international life mentioned at the beginning, subregional integration is one of the few possible solutions to the problem of dependence and underdevelopment from which most of the Basin's nations suffer.

In the case of Southeast Asia innumerable subgroups have appeared. Almost all suffer negative perspectives derived from the bipolar political tension that originated it. SEATO (Southeast Asia Treaty Organization which originatedin the Manila conference of 1945) and ANZUS (Australia, New Zealand and United States security treaty, signed September 1951) are security treaties with the purpose of helping the United States with military operations in the region. In 1967 the Japanese Prime Minister Sato and his counsellor Miki declared that Japan was interested in forming ASPAC (Asia-Pacific) which would attempt to join the Asiatic nations of the Pacific in a great regional coopeation project. However ASPAC excluded the socialist countries, even though it was generically referred to as a "promotion for cooperation between the advanced nations of the Pacific area". Between 1961 and 1967 the ASA (Southeast Asia Association) was in operation grouping together Malaysia, Thailand and the Philippines. From 1967 onwards ASEAN (Association of South East Asian Nations) was formed, uniting the ASA members and Indonesia and Singapore.

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3) Saburo Okita, Japan and the World Economy, Tokyo, JERC, 1971, page 47.

4) For the general Latin American view of its economic dependence on the United States, see the article by Maria Rosario Green, "Foreign investment help and dependence in Latin America", International Forum. El Colegio de México, XII: 1, 1971, pages 1-26.

5) See parenthesis 2.

Unfortunately, all of these organizations have ended up giving priority to military security over economic and social development.

It could be that ECAFE (Economic Commission for Asia and Far East), organ of the United Nations with a role similar to that of CEPAL in Latin America, could encourage a consciousness of Pacific regionalism, separating the great powers interested in exerting a hegemony in the area. Nevertheless, the climate of political tension and instability has not allowed the growth of that consciousness. Neither has the Asian Development Bank been able to do it, due to its heavy dependence on Japan and the United States.

In spite of many promises, the present decade does not seem to be one in which social preoccupations prevail over strategic and military ones. The great powers present in the Basin have a vital interest in maintaining the Ocean's unrestricted use. The product that crosses the Pacific in largest quantities and with most frequency is oil. Its scarceness in the world and its very important role in the powers' war machinery requires an equilibrium of military power in Southeast Asia, something very difficult to maintain. The Sino-Soviet conflict, the rising of Chinese and Soviet naval power and the fear of the spreading of socialist regimes in Asia have raised the continent's underdeveloped countries' military exenses above any consideration of economic and social development. It need only be said that twelve countries of Southeast Asia assign 8.2 percent of their GNP to military expenses, while those of the Andes Group assign only 1.4 percent.

Mexico uses in its armed forces a little over 4 dollars per capita. In other words, 0.6 percent of their GNP (calculated on over 600 dollars per capita). The states of Southeast Asia spend on their armed forces an average of twelve dollars per capita, or 8.8 percent of their GNP, which in terms of income per capita barely reaches 146 dollars.

If the Mexican proportion of 0.14 military personnel per inhabitant was applied to that region, we would have 669,634 men instead of 3,907,000. This would imply the allocation of 1,975 million dollars for defence, instead of the actual figure of 7,780 million dollars, even if average investment per man were to increase from 1,990 dollars per capita to 2,950 according to the Mexican average. This demilitarization would free 5,800 million dollars which could be used for socio-economic development.[6)]

The Latin American Pacific is not immersed in a war. In comparison with Southeast Asia, a larger proportion of its resources is used for the struggle against underdevelopment. Nevertheless, its dependence on the hegemonic pole of the United States is much more accentuated than that of the other side of the ocean. Multipolarity, key to the political and diplomatic strategy of Asia, does not yet exist in the Latin American Pacific. The military control of the United States via the Inter-American Treaty of Reciprocal Assistance, plus the bilateral agreements of the superpower with many countries of the sub-region, guarantee North American domination. We have already indicated the clear orientation of foreign trade of these countries towards the United Sates and their acute dependence on capital investments. Paradoxically, it could be said that Southeast Asia has the geopolitical elements for negotiating the reduction of its dependence on a superpower, but it does not do so be-

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6) The data on military expenses are from the IIDD publication, THE MILITARY BALANCE, 1972-73 and the studies of the Institute of Strategic Studies of London for 1970. See appendices 6 and 7 of this work.

cause economic development is not a realistic priority to most of the subregion's regimes, which are involved in problems of security and of maintaining the status quo. Meanwhile the Latin American Pacific attempts to speed up its process of independent development, but it lacks the geopolitical elements, as well as the transpacific contact paths necessary for reducing the high degree of dependence regarding the United States. For all purposes, it can be considered that the sub-region is totally dependent on the superpower and withdrawn from Asia's multipolar tensions.7)

The landscape of the Asiatic nations of the Pacific reveals little encouraging aspect: internal political instability in many of them, difficult economic relations with Japan (mostly due to the geopolitical factor), an anti-Chinese tendency intensified by the actions of the Chinese minorities in the southeast of the continent, apparently unsolvable conflicts between China and the USSR and a decline in regional integration efforts for development.

On the Asiatic side of the Basin, each of the four powers obtains benefits from conflicts between the others, but surely none desires any other to be involved in nuclear war. On the other hand, each one fears that the others ally against it. It can be said that, since the actions of the powers in the area will hardly produce alliances or antagonisms of the cold war type, the main characteristic of which was bipolarity and ideological upheaval, the tensions among the four powers will persist for a long time and a combination of two against a third one will not be easy.

In the Latin American side of the Basin, efforts for regional integration do not seem to have diminished dependence on the United States, which still has total military control over the sub-region and economic pressure of great intensity. At the same time, the socialist experience of Chile and the later establishment of a military dictatorship in that country have reduced even more the possibilities of political and diplomatic freedom.

Of the intermediate powers, Australia and New Zealand have showed a very low level of regional integration. In 1970 their foreign trade in the region reached only 30 percent of their transactions, while the other 70 percent was done in nations outside of the basin, mainly the United Kingdom and the European Economic Community.8) With its GNP growth rate, expansion of its foreign trade and its technological progress, Australia has an important role in the world economy, but the countries of the Basin, mainly the Latin American ones with their traditional isolation, are unaware of the Australian situation.

Canada's case is similar; although its presence begins to be felt in Latin America, its diplomacy for the south of our continent is still far from the strength that it could have. The historical background of Australia and Canada deserves careful attention by the Latin American countries. The type of economic nationalism that these two countries have, with a parallel situation in both of them (Canada regarding the USA and Australia regarding the United Kingdom), is frustrated by the activities of the transnational companies, which prefer to concentrate on the extracting and manufacturing industries. Under these conditions it becomes a lesson for the developing countries to establish national objectives for those giants by means of legislation which will allow effective control without closing the doors to the capital and technology that they represent.

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7) In this sense, see Mario Ojeda Gomez's analysis on the Rockefeller Report on Latin America: "The military and security relations", International Forum, X:3 1970, pages 257-264.

8) See table 4

The weak nations of the Pacific Basin do not seem to have considered carefully the fact that Australia, thanks to thorough exploration of its resources, will in this present decade become the world's largest exporter of such important minerals as iron, aluminium, coal, copper, lead and zinc.

The only important mineral product that Australia will import in significant quantities will be oil, even though its internal production increases at a considerable rate.

In Canada systematic exploration has been successfully undertaken, and this has led to the discovery of vast natural resources. Though Canada's GNP and its foreign trade grow at a rate slower than that of Japan and Australia, this is not due to a lack of resources, but to other factors. Maybe the most important of these is its dependence on the United States and Great Britain as markets for its primary products, as well as the difficulties that Canada finds for speeding up export of its manufactured products because of the restrictive policies that most of the industries owned by transnational firms in the United States impose and which are Canada's most important technology source. In spite of this, the Canadian economy will undergo a swift change, in which the governmental decision to sponsor and coordinate national scientific and technological effort with state financing is very important, assigning a considerable portion of the GNP to maintain this experimental measure.

In the uncertain conditions of the Pacific Basin we cannot omit the rise of the Japanese presence in Latin American markets. For Japan these countries represent a market for the products of its heavy and chemical industries, and they form an important group of economies receiving Japanese investment in the mining and manufacturing fields. At the same time this sub-region is an important source of iron and textiles for Japanese consumption. This double interest has been confirmed by the increasing of Japanese trade in Latin America and the rising level of direct and joint Japanese investments in many countries of the area.

According to Japanese calculations, Japan's economy will continue growing at the average annual rate of 12.4 percent in real terms during the first five years of the present decade. In monetary terms the GNP will reach 440,000 million dollars in 1975, in other words, an average of 17.5 percent annual growth. For that same year it is estimated that Latin America's GNP, in total, will represent barely 7.4 percent of the world GNP, while the Japanese is already 10 percent of the world.9) This growth rate necessarily implies a formidable Japanese participation in international trade. Japan will continue importing great amounts of raw materials and foods to maintain its growth rate. The Latin American countries have the natural resources that Japan needs, so they want to participate in exploiting these resources.

On the other hand, concentration of exports from Japan to the United States and the countries of Southeast Asia provokes friction and difficult situations which force Japan to increase the diversity of its export markets. Japan has concentrated its economic assistance projects in Southeast Asia partly for the convenience of supporting its commercial transactions with other underdeveloped areas, and this has proved to be politically unsustainable, judging by the reactions that this situation has provoked in the region.

The two socialist powers of the Pacific Basin do not participate in this international trade with the strength that should correspond

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9) According to data from a world economy projection in 1975. The Japan Economic Research Center, Japan's Economy in 1975, Tokyo, 1970.

to their economic potential. The secondary role assigned to foreign trade in planned economies partly explains this phenomenon, mainly in China's case which is still, in good measure, a society of self-sufficient development. Its trade surplus with some countries of Southeast Asia mentioned earlier on, is related to the presence of the Chinese communities in the area and to political rather than economic considerations.

On the other hand, it seems that China is willing to buy from those countries of the Third World whose governments are considered by the Chinese to be friendly regimes. Nevertheless, these purchases, like those in Mexico, barely modify the figures of commercial interchange in the Basin.

In recent years, the Soviet Union has shown a growing interest in Middle East Oil, the Indian subcontinent and the countries of Southeast Asia. It is presently enlarging its participation in transportation with modern merchant ships and systems that lower costs. Their ships can be found in all of the oceans of the world, mainly occupied with exploring and mapping the ocean. This effort is unsurpassed by other powers, judging by the size of its oceanographic and hydrographic fleet, which is larger than all similar fleets in other countries.

The present situation and the Soviet fleet's continuous growth allow the USSR a presence of great tactical importance in places where their political interests require them. This gives great psychological support to its diplomacy and opportunities to exert pressure in crisis areas. Nevertheless, regarding their foreign trade, the USSR seems to concentrate on a European dialogue and transactions with the other great powers. The commercial operations with the United States and the financial relations that can develop with the North American companies because of their high volume and their enormous political importance do not allow any parallel with the commercial transactions undertaken with Southeast Asia, and even less, with Latin America. Finally closer ties with Japan and the viability of joint exploitation of the natural resources of Siberia confirm this tendency.

From what has been said previously one can deduce that, in terms of commercial interchange, the Pacific Basin is still essentially a field of free enterprise in which two capitalist powers, the United States and Japan, dominate product interchange and capital investment. In this context the so-called transnational firms make their power felt, always enlarging. The most important ones have their headquarters in the United States or in North American interests, and participate actively in its financing and administration councils. United States diplomacy frequently supports the line of action of these multinational firms.10)

It is in this complex framework that the transference of technology in the Pacific Basin is undertaken. As in the structure of economic transactions, the interests of Japan and the United States dominate this important mechanism, with implications beyond the economic field. The transference of military technology and the training of technicians and professionals with consequent impact on education systems, involve extremely important political implications which can not be left unmentioned under the pretext of taking a purely technical approach to the problem.11)

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10) See table 7

11) There is an interesting resume of the discussion on the political implications of direct foreign investment in SEADAG Reports, Ad hoc Seminar on Multinational Corporations in Southeast Asia, Dec. 12-24, 1973 La Jolla, California, pages 11-15.

In the market of transference of technology from industrialized countries to underdeveloped ones government participate (via agreements of government to government cooperation), as well as international organizations (via ad hoc organs of the United Nations and other specialized agencies), and the transnational companies. The latter carry out a more ambitious and better coordinated operation.

In importing technology, the developing countries are trying to speed up their industrialization process, in response to growing popular demands for a better level of life.

When they resort to the transnational firms to provide them with this technology, they find that the transaction is frequently enclosed in a framework of stern conditions which undermines the economic and political independence of the weak states, to the point of becoming a threat to the country's sovereignty. That is why it is essential that the supposedly free technology market in the Pacific Basin be liberated, and this should be accompanied by the search for new sources in the socialist countries and by the joint efforts of developing countries on both sides of the Basin. Restricting the transnational firms' control of the technological markets, reducing the cost of that technology and increasing research in our countries so that they can adjust more closely to our demands seem to be immediate needs.

Finally, when attempting to delineate a scheme in which the transference of technology is to be effected in the Pacific Basin, it is important to keep in mind that although the region can be geographically separated in traditional terms, it is now in an age of global communication (which originated in the technological development of the superpowers) that links it so intimately to other parts of the world that it daily renders more obsolete the attempt to reduce it to its geographical form for purposes of analysis. The great powers have reached a stage of scientific advancement that allows them to perceive the world as a unit whose continental segmentation is merely an element for the designing of planetary policies and projects. It is symptomatic of the underdevelopment of our Latin American and Asian societies not to clearly perceive this fascinating phenomenon.

The result is that for the purpose of political, diplomatic and commercial planning the governments of the great powers key their operations in the Pacific Basin to those designed for other geographic zones. This can also be said of the transnational companies which only conceive their action at a global level.

When speaking of the powers in the Pacific Basin we consider that Western Europe, the fifth multipolar giant, is absent in the zone. This assertion is only valid in terms of relative influence on the great decisions that affect it. In the Pacific, the presence of Western European power is felt wherever traditional colonialism survives in Southeast Asia and where economic neo-colonialism is exerted over excolonies which, while politically independent nations, still depend in good measure on European markets for their economic life. It is a phenomenon which contributes to the universalization of the Basin's problems.

Appendix 1 Pacific Basin and World Trade (1970 data)

	Export Participation %	Import Participation %	Global Foreign Trade Participation %
WORLD TOTAL	100.0	100.0	100.0
Pacific Basin Total	41.0	40.0	40.0
Developed Areas	31.1	29.6	30.1
Japan	6.9	6.4	6.6
Australia and New Zealand	2.9	3.4	3.2
Canada	5.8	4.9	5.3
United States	15.5	14.9	15.0
Areas in development	9.8	10.8	10.4
Latin America	5.1	4.7	4.9
(Andes Group)	(2.7)	(2.3)	(2.5)
Asia	4.7	6.1	5.5
(Southeast Asia)	(2.1)	(2.7)	(2.4)

Source: Data compiled based on FMI: Direction of Trade, Number 7

Appendix 2 The Pacific Basin and The Interzonal Trade (1970 data)

	Export Participation %	Import Participation %	Global Foreign Trade Participation %
Pacific Basin Total	100.0	100.0	100.0
Developed Areas	77.0	71.4	74.2
Japan	18.3	17.1	17.7
Australia and New Zealand	4.4	3.4	3.9
Canada	17.6	15.4	16.5
Unitd States	36.7	35.5	36.1
Areas in development:	23.0	28.6	25.8
Latin America	11.8	13.2	12.5
Asia	11.2	15.4	13.3
(Southeast Asia)	(5.4)	(7.4)	(6.4)

Source: Data compiled based in FMI: Direction of Trade, Number 7

Appendix 3 Orientation of interzonal trade of the Pacific Basin in comparison to orientation towards world trade (outside of the Basin) - 1970 data

	exports % oriented to the Pacific Basin	imports % oriented to the Pacific Basin	total trade % oriented to the Pacific Basin
Pacific Basin	62.1	59.7	60.8
Developed Areas	63.0	58.2	60.6
Japan	67.4	64.8	66.1
Australia and New Zealand	38.6	24.1	30.6
Canada	77.5	75.0	76.3
United States	60.3	57.7	59.7
Areas in development	58.3	67.4	62.8
Latin America	58.3	67.4	62.8
Andes Group			
Asia	59.7	60.5	60.2
Southeast Asia	64.6	66.6	65.4

Source: FMI: Direction of Trade, Number 7

Appendix 4 Pacific Basin: relation of foreign trade dependence regarding Japan and the United States.

A) dependence on the United States:		B) dependence on Japan	
1.- Canada	85.0 %	1.- Southeast Asia	42.0 %
2.- Andes Group	65.0	2.- Asia	41.0
3.- Latin America	58.0	3.- Australia	37.0
4.- Australia	38.0	4.- Latin America	12.0
5.- Asia	38.0	5.- Andes Group	11.0
6.- Central America	38.0	6.- Central America	7.2
7.- Southeast Asia	29.0	7.- Canada	6.0

Source: 1970 data, compiled based in FMI: Direction of Trade

Appendix 5 Pacific Basin: relation between foreign trade and GNP

	Australia	Southeast Asia	Canada	Asia	Andes Group
(A) % total trade / GNP	42.5	32.4	32.3	28.3	21.8
(B) % trade outside of the basin / GNP	29.5	11.1	7.6	11.3	6.9
(C) % interzonal trade on GNP	13.0	21.3	24.7	17.0	14.9
(D) % trade with USA on GNP	4.9		21.0		10.0
(E) % trade with Japan on GNP	4.8	9.0		7.1	
(F) % trade with the other countries of the Basin / GNP	3.2	12.3	3.7	9.9	4.8

Source: 1970 data, compiled based in FMI: Direction of Trade

Appendix 6 Pacific Basin: Population, Wealth and Defense (1970)

	Pacific Basin Totals for 31 Countries	Pacific Basin Asian Region		Pacific Basin American Region			
		Total	Except China	Total	LatinAmerica and Canada	Latin America	Mexico
A - Population	1,612,090,000	1,258,310,000	478,310,000	353,780,000	143,780,000	121,980,000	52,200,000
B - Armed Forces	9,575,447	6,787,247	3,907,247	2,788,200	397,200	313,200	73,200
C - GNP	1,728,570,000	493,790,000	365,790,000	1,234 780,000	161,880,000	66,310,000	32,000,000
D - Defense expenses	106,673,500	19,780,300	7,780,000	86,293,000	2,893,234	956,000	216,000
D/B-Military/Defense expenses	11,800	2,914.33	1,991.24	30,949.40	7,284.07	3,054.23	2,950.80
C/A-GNP per capita	1,072.30	392.42	764.75	3,490.24	1,125.88	543.61	613.02
D/C-% Military Expenses in the BHP	6.13	4.00	2.12	6.99	1.78	1.44	0.67
B/A-Military Personnel per Inhabitant	0.55	0.53	0.81	0.78	0.27	0.25	0.14
D/A-Defense Expense per Inhabitant dollars	65.80	15.72	16.26	243.91	20.12	7.84	4.13

Source: The table has been compiled according to data extracts from: The International Institute for Strategic Studies, The Military Balance, Vols. 1970-71, 1971-72, London.

Appendix 7 Order of the Pacific Basin Countries According to the Percentage of GNP on Defense Expenditure (1970)

	% of the GNP in Defense	GNP per capita U.S. $	dollars per capita for defense
Cambodia	22.40	206.89	46.34
North Korea	15.82	195.80	30.98
Singapore	9.97	1,162.70	115.95
Taiwan	9.85	414.96	40.88
P.R. China	9.37	164.10	15.30
South Vietnam	9.27	243.52	30.46
United States	7.77	5,109.04	397.14
Malaysia	7.21	389.26	28.09
Laos	6.80	81.96	5.57
South Korea	5.25	253.12	13.35
Thailand	3.78	173.91	6.58
Australia	3.47	3,323.84	115.38
Peru	2.58	440.05	11.36
Chile	2.55	316.14	17.64
Indonesia	2.33	95.71	22.38
New Zealand	2.04	2,567.01	52.43
Canada	2.02	4,383.94	88.83
Equador	1.76	230.77	4.07
Philippines	1.24	189.74	2.36
Colombia	1.22	316.14	3.85
Japan	1.02	2,410.20	24.57
Mexico	0.67	613.02	4.13

Source: The table has been compiled according to data extracted from: The International Institute for Strategic Studies: The Military Balance, Vols. 1970-71, 1971-72

Appendix 8 Number of Foreign Subsidiaries of 187 Multinational Firms Controlled by the Unitd States , Classified According to the Property Group of the System, 1967

Area	Property degree to the system[a]				
	Total Property	Majoritarian Property	Minoritarian Property	Unknown	Subsidiary Total
All foreign areas	5,143	1,457	660	667	7,927
Canada	817	101	44	86	1,048
Latin America	1,195	365	197	167	1,924
Mexico	230	79	61	42	412
Argentina	115	36	20	16	187
Brazil	173	48	16	30	267
Europe and United Kingdom	2,221	651	227	302	3,401
European Community	1,025	351	137	162	1,675
France	256	133	62	42	493
Germany	293	84	26	53	456
Italy	188	70	19	33	310
EFTA	1,037	196	53	119	1,405
United Kingdom	554	129	38	79	800
Rest of Europe	159	104	37	21	321
South Domain	460	113	37	38	648
Asia and rest of Africa	450	227	155	74	906
Japan	72	71	65	25	233
India	29	23	28	6	86
Black Africa	112	28	20	6	166

a) "Total Property" means that the system's matrices have 95% or more of stocks with the right to vote; "Majoritarian Property" from 50 to 94%; "Minoritarian Property", from 5 to 49%.

Source: J.W. Vaupel and J.P. Curban, The Making of Multinational Enterprise (Boston: Harvard Firm Administration School, 1969, Chapter 3.

Comments on Legorreta's Paper - Helen Hughes

I propose to take up some of the issue more particularly concerned with the transfer of technology.

Firstly, I would like to raise some definitional points. The problem, it seems to me, is not simply one of "the transfer of technology" but rather a series of problems concerned with the transfer and adaptation of appropriate technologies. A wide range of engineering and management practices, attuned to varying skill, management and market conditions is characteristic not only of industrialized countries, but also of rapidly growing industrializing countries which pay adequate attention to the matching of technologies with changing factor endowments and national and international market opportunities. "Best practice" technology in an economic sense is thus a spectrum of engineering and management practices. When the "shelf" of existing technologies available in developing as well as developed countries is taken into account, the choice is very considerable. This applies not only to manufacturing, mining power and other "modern" sectors, but also to agriculture, construction and the service sector where the bulk of the G.D.P. (if measured in international, rather than protected local prices) is created.

To ignore the range of appropriate technologies available, or to allow an economy to be divided into two sectors--a technologically complex and capital intensive, highly productive modern sector and a traditional, informal sector of low productivity--is to ignore the social aspects of development and to place a brake on the pace of development by failing to utilize important natural resources--people.

It seems to me that Dr. Legorreta's paper is in some danger of failing to stress the complexity of the transfer and adapatation of appropriate technologies by concentrating solely on the transfer of highly complex and capital intensive technologies for the modern sector. It is true of course that in this sector the multinational corporations are important in technology transfer, although it must be noted that this is not necessarily so in all modern sectors. The most advanced technology for steel, fertilizers and power generation--to name but three very important basic industries, is available in a quite competitive patent, license and construction market without ties to direct capital investment.

Dr. Legorreta's paper, however, concentrated on the less competitive technology transfer markets, consisting mostly though not entirely, it should be noted, of semiluxury and luxury consumer goods. Here, if I may caricature the "Latin American Viewpoint" a little, I am reminded of a situation in which a young lady or gentleman accepts an invitation from a person of the opposite sex to visit their apartment late at night, and, two brandies later, cries "rape! rape!" There can be no doubt that the prime purpose of multinational corporations is to make the maximum profits they can, that they are usually operating in an oligopolistic or monopolistic environment, and that they bring whatever pressures to bear they can in bargaining. But far from fighting back on just as tough a basis (as several, in some cases more economically backward, developing countries in other parts of the world have done), the Latin American countries have given the multinational corporations high protection for integral

markets, high incentives for exports and capital incentives of various sorts. Until quite recently they failed to attend to the building up of the technological and administrative expertise which make adaptation and arm's length pricing possible, let alone mandatory.

It seems to me that three principal conditions have to be satisfied if an equitable transfer and adaptation of appropriate technologies is to take place.

Firstly, the overall development strategies have to take into account equity as well as output growth objectives. Such an approach would form intersectorial priorities, the linkages between the "low" and "high" technology components of sectors and of the economy as a whole, and thus provide the basis for a mass consumption market for consumer goods, services and for production inputs, particularly into agriculture. This theme is taken up in Dr. Helleiner's paper.

Secondly, the price structure determined by trade, monetary, fiscal and other policies has to be at least headed in the right direction. This does not mean a pure free trade approach, but it does require the elimination of the extremes of distortion which at present characterize most Latin American (and many other) economies, inhibiting rather than encouraging socially desirable behavior by foreign owners of technology as well as the local, private and public purchasers.

Thirdly, there seems to me to be a need for far greater attention to the absorptive technical and administrative capacity particularly for adapting technology to local needs. A socially oriented overall strategy and sensible price signals are necessary conditions, but they are not likely to be sufficient for the creation of a vigorous entrepreneurial, technological community capable not only of purchasing technology on equitable grounds and adapting it to local needs, but also of that indigenous innovation which is one of the prime sources of comparative advantage in the modern world.

The policies needed to create the vigorous entrepreneurial absorptive approach to technology are obviously wide reaching. A rigorous yet practically oriented education and research structure is essential to create skills at all levels from the factory floor and farm field upwards. It is important to note that population planning is essential to the widening and deepening of human-skills and capital labor ratios. Countries that do not adopt population planning policies place themselves at a very grave disadvantage in the technological race. The creation of an administrative structure can consolidate to the improvement of the state of knowledge about technological needs as well as sources of supply and thus make arm's length bargaining more likely. The international exchange of information among developing countries could moreover, lead to an important extension of information.

2

SOVIET VIEWPOINT (1)
EMERGENCE OF THE PACIFIC ECONOMIC COMPLEX AND SOME ASPECTS OF THE ECONOMIC RELATIONS BETWEEN THE SOVIET UNION AND THE PACIFIC COUNTRIES

V. YAKUBOVSKY

Processes which have been developing in the Pacific area in recent years turn it into a new political and economic centre of the capitalist world. Of special significance among these processes is the formation of the ever deeper, closer and stabler relations in foreign trade, investments, and technological exchange between the countries of this area. All this makes it possible to speak of the tendency towards the emergence of the Pacific economic complex.

Economic and manpower potential which may become associated with the newly emerging economic unit is great. The territory of either Pacific or economically Pacific-oriented capitalistic countries is about 42 million square kilometers, which is more than one-third of all dry land. These countries account for about 40 percent of the world population. In 1971 GNP of the five leading capitalist countries of this area comprised 1,400 billion dollars, nearly double the GNP of the nine EEC countries.

A number of global and regional factors predetermined the development of the abovementioned trends.

First it should be noted that scientific and technological revolution, as well as structural changes in the economy, have caused further deepening of the international division of labour and internationalization of individual economies, which in their turn made necessary the rapid growth of international economic relations. The latter includes those between the Pacific countries.

One of the regional prerequisites was the rapid growth of the economic potential of a number of Pacific countries, particularly Japan, which has become the second economic power in the capitalist world. Rapid development of such "medium" capitalist countries of this region as Canada, Australia and New Zealand has opened the way for their extended participation in Pacific regional economic intercourse. At present some of the industrially advanced capital ist countries have reached certain comparativeness of the level of their economic development, which sets the basis for possible integration processes among them. The relatively fast economic development of some countries of East and Southeast Asia, makes possible their more active participation in the new division of labour in this area.

Establishment of trans-Pacific economic ties was speeded substantially by formation of vast coastal industrial urbanized zones in the leading capitalist countries of the area. The Californian megalopolis in the US, which has emerged as a result of vigorous development of the Pacific coast states in the post-war period, can be cited as an example of such zones. Another example is the Pacific coast industrial belt of Japan, which at the end of the sixties accounted for 72 percent of the population, 81 percent of the industrial enterprises and 87 percent of the manufacturing industries output of the country. The same might be said about the largest industrial cities and ports of Australia--Sydney, Melbourne, Brisbane--as well as about fast development of the Canadian Pacific coast and establishment of industrial centers there.

Technological progress in merchant marine and sea transportation has contributed to turning the Pacific into a powerful integrating factor. This was also assisted by the rapid development of air transportation and other means of communication in this area.

Large deposits of minerals and fuel in Australia, Canada and along the Pacific coast of Latin America, as well as traditional world-wide-scale production of natural rubber, tin, jute, copra, and other products in the countries of Southeast Asia provide a raw material base for the emerging capitalist economic unity.

When raw materials and energy become scarce, substantially due to the practices of giant transnational corporations, the resources of Pacific Ocean will play a special role in the economic development of this region, especially considering progress in oceanography and development of economically sound technology of the ocean resources extraction industry.

The Pacific Ocean is a giant store of mineral resources and a source of valuable food products. According to the estimates of the US experts, the seabed of the Pacific Ocean contains eight billion tons of copper, 15 billion tons of nickel, 358 billion tons of manganese and five billion tons of cobalt, which at the 1972 rate of consumption is sufficient for 1,100, 23,500, 34,800 and 260,000 years correspondingly.

It is significant that unlike the mineral resources deposited in the dry land, "ore nodules" are permenently reproduced at a rate of thousands of tons a year. Compared to the world output in 1972, the annual formation of copper on the seabed of the Pacific is 0.8%, nickel 16%, manganese 24% and cobalt 180%. In some time their extraction may prove to be more profitable than mineral extraction on the continents.

Geological structures suggesting potentially rich deposits of natural oil and gas, were discovered in the shallow seas of the Eastern and Southeast Asia and near Australia. Their industrial development would make this region one of the largest world producers of these valuable raw materials and fuel, which could compete with the countries of the Near and Middle East.

In recent years the Pacific Ocean has become the world sea fishing center. Investigation and practical utilization of its vast food resources are urgent problems.

The emergence of the new economic complex in the Pacific area was accompanied by deep changes in the system and nature of economic ties between the capitalist countries of this region, and especially of foreign trade relations between them. Characteristic of the latter was their dynamism which contributed to the economic development of the region and opened avenues for economic rapprochement. In the period 1960 to 1972 overall export of the five largest capitalist countries of the region and of the developing

nations of the Pacific Asia area, has increased more than twofold.

In the post-war period considerable restructuring of regional trade relations took place, especially between the countries of the Western Pacific. Before World War II the Pacific Asian countries--then colonies--were tied to European monopolies in their foreign trade. Great Britain traditionally accounted for the major share of the foreign trade of her former dominions, Australia and New Zealand.

Starting in the fifties, the process of regionalization of foreign trade of the Pacific countries has become much more active. It involved first of all such industrially developed countries as the USA, Japan, Canada, Australia and New Zealand. Between 1954 and 1972 the share of intra-regional export of these countries increased from 29.8 to 45.7 percent, compared to their overall export. Corresponding figures for intraregional import were 38.8 percent in 1954 and 49.9 percent in 1971. It is noteworthy that those figures do not differ significantly from the similar indicators for the Common Market countries although expansion of foreign trade between the Pacific countries is taking place under far less favourable conditions than that of the EEC.

The abovementioned countries have restructured their foreign trade towards the region to a different degree. Considering the weakening of traditional ties with Great Britain and her membership in the Common Market which have shaken the preferential position of Australian and New Zealand products on the British market, the latter two countries have decisively moved towards regional trade. Whereas in 1954 the other four of the five already mentioned Pacific countries accounted for 16 percent of Australian imports and 19 percent of its exports, in 1971 their share was 44 and 48 percent correspondingly. The share of export operations of New Zealand with the Pacific four has increased from 10 to 37 percent during the same period. At the same time the US, which followes a global foreign trade strategy, has increased the share of its exports to the Pacific countries only from 24 to 35 percent, and their imports from the Pacific from 28 to 46 percent.

At the same time it should be noted that the process of re-orientation of foreign trade towards the region has gone beyond those five industrially developed capitalist countries of the Pacific area, and has to a greater or lesser extent involved virtually all the nations of this region. It would be enough to note that during the last two decades the share of intraregional export in the total export of the five industrially developed capitalist countries and of the developing countries of the Pacific Asia has reached 56 percent.

Owing to the fact that formation of the new regional trade pattern took place within the framework of a capitalist economy, a corollary of which is the uneven development of different countries, the specific positions of various states within the newly emerging Pacific division of labour happened to be very much different and far from equal.

Dominant positions in the arising economic community of capitalist countries are occupied by the USA and Japan which account for 20 and 13 percent respectively of all mutual export operations of the Pacific countries, while similar figures for the countries of the rest of the Pacific Asia area and for Australia and New Zealand correspondingly are 9 and 3 percent.

Trade and economic relations between these countries of the area, which may be characterized as relations of both partnership and competition, are an important component of the system of regional

economic ties. In 1972 mutual export between the USA and Japan, which are the largest trade partners not only in the region but in the world, was 13.8 billion dollars or more than 20 percent of the total intra-regional export in that year. Special place belongs to the trade between Japan and the rapidly advancing Pacific coast of the US. "Our trade with such states as California, Washington or Hawaii exceeds our trade with any European country"--once remarked Mr. M. Ohira, Minister of Foreign Trade and Industry of Japan.

Structural shifts in the Japanese industry and in its trade with the United States have made Japan a dangerous competitor of the US in the markets of new industrial products and processes. The share of heavy and chemical industries products in Japan's exports to the USA has increased sharply from 17.3 percent in 1955 to 78.1 percent in 1972, while the share of machinery and equipment in America's exports to Japan is only 28.5 percent. In 1972 Japan managed to sell in the US market 8.5 billion dollars worth of industrial goods (with respect to which the clash of interests of American and Japanese corporations is most acute) while the USA sold only 2.7 billion dollars worth of such products in Japan.

In the 70s one can expect trends towards further increase of trade and economic relations between Japan and the USA due to such factors as structural shifts in American and Japanese economies under the impact of scientific and technological revolution. These shifts increase mutual dependence on the other country's market, speed up the process of assimilating each other's capital, widen the use of state-monopoly methods of economic control, as well as increase exchanges of a political nature.

At the same time trade and economic contradictions between the USA and Japan will keep growing and cover new spheres of activity. These anomalies are caused by sharp shifts in the balance of power between the two countries both with respect to regional and world economy and by the unprecedented expansion of the Japanese corporations in the American market. Underlying these conflicts of interests is the desire of both the USA and Japan to provide their monopolies with advantageous positions in the competitor's markets, while at the same time protecting domestic markets of uncompetitive products by some sort of protectionist measures, usually of an indirect nature.

The growing protectionist mood in the USA, restrictions on American agricultural exports to Japan, difficulties in promoting American products in the Japanese market in spite of considerable liberalization of import operations in Japan continue to nourish Japanese-American trade contradictions even though the problem of trade balance deficit between the two countries has become less acute.

Mutual penetration of capital has been proceeding rapidly during recent years, although the significance of capital exchange in the total structure of economic relations between the two nations still falls behind their foreign trade. In particular, private direct investments of the USA in Japan have increased 10 times during the last decade and amounted to nearly 2.2 billion dollars in 1972. At the same time total Japanese direct investments in the USA were only 1.4 billion dollars.

Due to the restriction upon import of capital which existed in Japan until recently, export of private American capital to that country had only a minor share in the total foreign investments in the Pacific countries, accounting for only one-sixteenth of the total investments in the developed capitalist countries of the area in 1972. At the same time about one-fourth of the Japanese invest-

ments in the Pacific area were made in the USA.

There are noticeable differences in the structure of American and Japanese investments. Serving the promotion of export expansion on the American market, 60 percent of the Japanese investment in the USA are made in trade and services and only 10 percent are directed to the manufacturing industries. On the contrary, American capital in Japan is invested in the most modern branches of industry, such as oil, chemical, electric and general engineering industries.

Due to a number of reasons one could expect rapid growth of the mutual export of private capital by the two countries, which will contribute to deepening economic ties between them. At the same time this process is likely to produce a number of specific problems, which may result in no less sharp relations between the two countries than those which existed at the time of substantial trade imbalance in favour of Japan.

Because of the scale of trade and economic relations between the two leading industrial powers of the capitalist world, aggravation of trade and economic clashing between the USA and Japan cannot but have a destabilizing effect upon the system of economic ties in the Pacific area.

The ever-increasing role in the system of economic ties, especially among the countries of the Western Pacific, belongs to the mutual economic dependence of Japan and Australia, to formation of stable and long-term ties between them. Very similar trends can be noted with respect to relations between Japan and New Zealand, although these relations are not yet at the same level of development. Underlying it is the rapid development of trade relations between those countries, above all between Japan and Australia, which took place as a part of re-orientation of Australian trade and economic ties towards the Pacific Asian countries, which in the beginning of the seventies accounted for about 66 percent of Australian export and 53 percent of its imports.

During the last two decades the share of Japan in Australian export has increased from four to 29 percent, the USA from eight to 12 percent, New Zealand from three to five percent, while the share of Great Britain has sharply declined from 39 to 11 percent. Japanese penetration of the Australian markets has been rapid. The share of Japan in Australian imports has increased 16 times during the last 20 years and is now 16 percent, while the share of the USA has increased from 10 to 25 percent, and the share of Great Britain has considerably declined from 52 to 21 percent. Australia has become the second after the USA as a trade partner of Japan.

In the newly emerging economic complex Australia supplies raw materials and high-quality foodstuffs, and--to a lesser extent--machinery and equipment in exchange for Japanese industrial goods. The following data prove a high degree of mutual trade and economic interdependence: in 1971 Japan received from Australia 100 percent of imported alumina, more than 54 percent of bauxite, about 40 perent of iron ore and concentrates, about 33-1/3 percent of coal and more than 88 percent of wool and beef. In all of Australia's exports Japan's share 87 percent of iron ore and concentrates, 83 percent of coal, 95 percent of salt, 53 percent of timber products and 42 percent of wool.

A particular feature of trade exchange between the two countries is a considerable positive balance in favour of Australia. In the year 1971/1972 Australian exports to Japan were double its imports from that country.

Economic ties between the two countries show a tendency to

strengthen. Besides trade, investment relations also developed between the two countries, mostly due to the export of Japanese capital to Australia. Japanese private direct investments in Australia are still small compared to those of the USA and Great Britain. They are directed mostly to the raw material and mineral extraction industries and pursue the aim of providing stable supplies of raw materials and concentrates for the growing Japanese industries.

Behind the rapidly developing Japanese-Australian ties, as well as similar ties emerging between Japan and Canada and between Japan and New Zealand, there are international monopolies, sometimes with local participation, and of course the US transnational corporations. The gigantic size of these corporations, their growing role in the economies of individual countries and their global strategies which sometimes intrude upon the national interests of particular states, cause deep concern in the business and political community, mostly in the "medium" capitalist countries of the region. It should be noted that competition and cooperation among these giants may have a strong influence on the development of economic ties between Japan and Australia, as well as on the formation of other similar regional economic complexes and on their place in the structure of economic relations in the area as a whole.

It seems likely that in the near future there will be further strengthening and widening of economic ties between the two countries, including technological exchange, on the basis of comparatively rapid development of both economies which continue to maintain their mutually complementary nature.

Together with increasing export of iron ore, coal, non-ferrous metals, etc. to Japan, Australia is considering starting export of new types of raw goods, in particular enriched uranium. Australian business opinion believes that the growth of GNP per capita in Japan, adoption of the "Tanaka Plan" with its stress on the "quality of life" and changes in the tastes of Japanese consumers will contribute to the growth of Australian export of high-quality products to Japan.

In the light of the energy crisis in the capitalist countries, the lack of a number of raw materials and the struggle between the US and Japanese monopolies for fuel and energy resources, one could expect greater Japanese interest in deliveries of raw materials from the "fifth continent". According to some estimates, by the end of the seventies Japan will account for about 42 percent of Australian exports. By 1975 about half of the Japanese demand for iron ore and coking coal will be covered by deliveries from Australia.

At the same time one could also expect increased export of Australian manufactured goods to Japan, particularly processed raw materials. This may happen as a result of the Japanese desire to move abroad industries known for environmental pollution, as well as higher transportation costs associated with importing raw materials in large quantities and the desire of Australian manufacturers to raise the price per unit of exported products.

Politically a treaty on trade and navigation presently considered by both governments and previously opposed by the Australian political and business community because of the possible greater Japanese economic influence, could contribute to strengthening and broadening the already existing economic ties.

Several factors will work against developing trade and economic relations between two countries, towards aggravating disparities between them. Among these factors is the Japanese policy of agricultural protectionism, which to a substantial degree touches upon

the interests of the Australian exporters of agricultural products. With a deficit in the trade balance of Japan one also cannot exclude her striving to balance this considerable deficit in her trade with Australia.

Trade and investment expansion of the Japanese monopolies will find certain obstacles in the recent measures of the Australian Labour Government, aimed at establishment of control over foreign investments in order to observe the national interests more closely and to increase participation of local business in developing natural resources of Australia.

The problem of prices of Australian raw materials, fixed in long-term contracts with the Japanese importers seems to be growing into a serious difficulty. When tied to the US dollar, Australian manufacturers had to bear significant losses as a result of devaluation of the dollar and general instability of the capitalist financial system. It has also been disclosed in Australia that a number of long-term contracts provide for deliveries of raw materials to Japan at prices below the world level.

Considering both centrifugal and centripetal trends in Japanese-Australian relations, one still has to expect a greater role of the emerging complex: its greater impact on the system of regional economic relations. Japanese participation in this complex will to a certain degree lessen her dependence on US raw materials. Both countries will try to use the potential of economic cooperation to improve their position in the developing countries of Pacific Asia, with Australia looking first of all towards her position in Southeast Asia. The struggle for the markets in those countries will result in aggravating contradictions between Japan and Australia.

During the postwar period the developing countries of East and South Asia were drawn into the capitalist structure of economic ties in the Pacific area. The degree of regional dependence of some countries of East and Southeast Asia has increased from 39 to 84 percent in exports and from 43 to 82 percent in imports.

While establishing economic relations with the developing countries of Pacific Asia, the developed capitalist countries of the area are interested in them not only as a source of raw materials and a large market for their products but also as reservoirs of cheap and relatively skilled labour. They are also interested in using the territories of these countries especially because of air pollution in the largest industrial centers of the capitalist countries.

The two greatest capitalist powers of this region--the USA and Japan--hold leading positions in economic relations with the developing nations of the area. Relations between them are competitive and in some cases cooperative in Pacific Asia.

During recent years the Japanese monopolies, as a result of their broad trade expansion, have managed not only to overtake American exporters in the markets of the Pacific Asia countries (in 1972 total Japanese exports to these countries was 5.2 billion dollars, or 1.5 times higher than that of the US), but also to press them in the traditional markets of Latin America. One can also expect future clashes between the two countries in their struggle for Chinese markets and raw materials.

The imperialist trade struggle was made even sharper by the desire of some Western European countries to maintain or even to expand their markets in the Pacific countries, using to this end the potential of the EEC, whose export to the Pacific Asia countries has doubled, reaching 2.1 billion dollars in 1972. During the same period Australia, which is striving to firm its position in the

markets of Southeast Asia, has increased its export to the countries of the region by more than three times.

At the same time the USA continues to maintain absolute leadership in export of private capital to these countries, which contributes to maintaining long-term positions in the area. In 1971 private direct investments of the USA were 3.1 billion dollars, compared to only 0.8 billion dollars of Japanese investments. In recent years Japanese monopolies have sharply intensified export of capital to the countries of Pacific Asia in order to "dovetail" their economies with the economic needs of Japan on the basis of "new division of labour" in the area. In spite of a certain degree of industrial and economic development Asian countries again happen to be in the dependent position in the emerging division of labour because they develop labour- and capital-intensive industries, usually with an unfinished cycle of production, while head enterprises and science-intensive industries remain in Japan and in other industrially developed capitalist countries.

In order to develop their economy on the basis of modern technology and to take joint measures against expansion of the transnational monopolies, the developing countries of Pacific Asia are beginning to increase subregional economic cooperation, including that within the framework of ASEAN, which, of course, contributes to the establishment of subregional economic complexes.

In general, two contradicting tendencies will exist in the region in the future. One is the definite development of stable long-term ties, preparing conditions for integration on a private-monopolistic basis. The other tendency is the centrifugal trends due to the still great gap between the levels of economic development of the leading capitalist powers, to the enormous gap between them and the developing nations of the region and also to some extent, to the US desire to follow the global and not the regional strategy, as well as to the Atlantic orientation of Canada in her economic contacts.

For historical, geographical and economic reasons the Soviet Union is the one of the largest Pacific powers. A high level of economic development, richness of natural resources and the size of its domestic market dictate the simple necessity of the USSR's participation in the emerging complex of economic ties in the Pacific area.

Recently, decisions of the higher party and government organs of the Soviet Union put forward the task of accelerating development of Siberia and the Far East--that is the areas directly bordering the Pacific. Measures are planned to increase the energy base of that area, to develop large-scale projects of exploration of natural resources, timber, fishing, general engineering and other industries and agriculture, to modernize existing communications and to construct new ones, including new ports. An important step in this direction is the construction of the Baikal-Amur railway which will provide access to the natural resources of Eastern Siberia and the Far East and will assist in formation of a large new industrial region.

Success already achieved in the economic development of the Eastern regions of the USSR, as well as complex development of the economy of Siberia and the Far East, contribute to the increasing overall economic potential of the Pacific area and has created the conditions for greater participation of the Soviet Union in the international division of labour in the Pacific.

A specific feature of the economic relations of the Soviet Union with the countries of the vast Pacific region is that the USSR has to deal with a number of states different in their social systems,

levels of economic development, territories, population, patterns of trade and economic ties, etc., which certainly creates some difficulties in developing relations with them.

The Soviet Union maintains diversified economic relations with those states. Total trade of the USSR with the countries of the region has increased nearly twice during the last ten years and was 4.5 billion roubles in 1972, which was about one-fifth of the total volume of foreign trade of the USSR. The USSR has provided economic and technological assistance to the developing countries of Pacific Asia. It has also promoted international specialization and cooperation, technological exchange, credit relations, as well as joint ventures in the exploration of natural resources, construction of industrial enterprises, etc.

The leading place in the economic ties of the Soviet Union with the countries of the region belongs to the socialist countries which account for more than 40 percent of the Soviet foreign trade in this region.

Membership of Mongolia and Cuba in the Council for Mutual Economic Assistance (CMEA) made possible their closer economic relations with the Soviet Union and transferred the focus of those relations from foreign trade to the field of production, capital construction, science and planning.

Participation of the Mongolian People's Republic and Cuba in the complex programme of economic integration of the socialist countries has opened the way to new forms of bilateral and multilateral economic cooperation which considerably accelerate their economic development and increase efficiency of production. These forms include joint Soviet-Mongolian enterprises for the exploration of copper-molybdenum deposits (one of the largest projects of this kind in the world) for the exploration of fluorspar, non-ferrous and rare metals, as well as a decision to set up nickel-producing enterprises in Cuba through the joint efforts of several countries.

The Soviet Union and the other member countries of CMEA stand for further development of economic relations with all the socialist countries, including those which are not members of CMEA at present. Most of these are countries of Asia.

The Soviet Union supports steady development of cooperation with the developing nations of the Pacific Asia region--cooperation which assists these countries in starting to solve their basic problems of economic development, in undertaking progressive socio-economic reforms and fulfilling programmes of economic construction responsive to their national interests. Trade between the Soviet Union and these countries has increased from 0.3 billion roubles in 1960 to 0.7 billion in 1972. The major trade partners of the USSR among this group of countries are India, Pakistan and Malaysia.

The USSR supplies the developing countries of the Pacific Asia with machines and equipment, as well as other manufactured products. Exports of those countries to the USSR consist mostly of raw materials and food items, but in recent years some of them have expanded exports of manufactured goods, including those produced by the enterprises constructed with the assistance of the socialist countries. So, Indian exports to the USSR include such new items as rolled metals, tires, medicine, footwear, instruments, clothing and knitwear.

Division of labour emerging between the Soviet Union and the developing countries of South and Southeast Asia is based on large-scale technological assistance provided to these countries through construction of industrial, transportation and agricultural enterprises, as well as in training manpower for these enterprises.

Large metallurgical and non-ferrous metals plants are being constructed with Soviet participation in India, and general engineering plants in India and Sri Lanka.

Credits are usually provided to pay for complex deliveries of equipment for the enterprises under construction. On one side, it makes it easier for the developing nations to implement their plans of economic development. On the other it promotes selling Soviet goods in their markets, widening mutually beneficial trade and economic relations in general, and gives cooperation its long-term and stable nature.

Newly developing cooperation between the USSR and the developing nations, especially India, in the field of long and medium term planning will contribute to further cooperation and division of labour between them.

In the future, closer economic cooperation of the Soviet Union with the developing countries will include both technological and credit assistance, as well as technical cooperation which will embrace state industrial enterprises constructed in those countries. Joint enterprises also seem possible, which could contribute to improving industrial relations, utilization of advanced technological experience, better use of production capacities, sales and so on. Formation of rational division of labour with the developing countries is inseparable from consideration of their needs and with the expansion of production capacities to meet those needs.

Objective needs connected with the development of the world division of labour, existence of states with different social systems in the Pacific area, improvement of international climate and positive shifts in the relations between the Soviet Union and the leading capitalist states, five of which belong to the Pacific area, determine the necessity of accelerating trade and economic relations of the USSR with these countries.

Among the factors providing favourable conditions for considerable expansion of trade and economic ties between the Soviet Union and industrially developed capitalist countries of the region are the following:

--high levels of economic development and a considerable degree of complementarity between the different branches of the economy of the USSR and some capitalist countries of the region (notably Japan and the USA) provide possibilities for a wide spectrum of mutually beneficial economic ties;

--geographical location of these countries makes relations between them logical; it also makes it possible to save on freight and time of delivery due to the improvement of sea transportation. This is especially important for mass deliveries of raw materials --oil, coal, ores, timber, etc. Thus, delivery of oil from Nakhodka to Niigata takes only two days, while from the countries of the Near and Middle East 22 days. The cost of freight, according to the estimates of Japanese economists, is six times lower. Transportation costs for deliveries from the eastern areas of the USSR to the Pacific coast of the USA and reverse are substantially lower than those for transportation to Western Europe;

--the problems of energy and raw materials facing capitalist countries, particularly Japan and the USA, stresses the necessity of cooperation with the USSR in the exploration of the power and mineral resources of Siberia and the Far East which are rich with coal, oil, natural gas, iron ore, timber and non-ferrous metals;

--the task of accelerated development of the eastern areas of the USSR creates a promising, large and permanently growing market

for the general engineering and consumer goods of the countries of the Pacific;

--finally, of no small significance is the fact, that the Soviet economy knows no depressions or crises. Its planned development guarantees a corresponding increase of foreign trade and accurate fulfilment of the obligations taken.

Recently there was an expansion of trade between the USSR and the economically developed capitalist countries of this region. This trade has more than doubled since 1965 and was 1.8 billion roubles in 1972. Of course, this figure reflects neither latent capabilities nor interest in cooperation between the abovementioned countries.

Together with the growth of trade and other ties there are shifts in their structure due to cooperation in science, technology and license exchange.

To be considered presently is the problem of large-scale joint projects, including those on a compensation basis, which provides for participation of the countries of the Pacific area in construction of extraction and other enterprises in Siberia and the Far East with the following compensation credits in the form of products of corresponding enterprises. It also provides for industrial cooperation and credit relations.

Considerable experience in this has already been acquired through cooperation with Japan, especially in exploration of the local resources of the Far East and during construction of the Eastern ports. An important stage in utilization of opportunities for Soviet-Japanese economic cooperation was the inter-governmental protocol on a bank credit of 1,050 million dollars, signed in April 1974--the largest such credit in the history of Soviet foreign trade. This credit will cover purchase of machinery, equipment, ships, construction materials and consumer goods which will be necessary in order to implement the projects concerned with developing coking coal deposits, exploration for natural gas in Yakutia, and further exploration of natural resources in the Far East.

Possibilities open for multilateral cooperation in the exploration of Siberian resources, specifically, Yakutian natural gas, for industrial construction in the Far East and for applying this experience in other parts of the area in the future. In this context one cannot but agree with the estimate given by the American scholar Malmgrenn who stressed that possible cooperation of the USSR, USA and Japan in the exploration of Siberian resources could become a model to be applied in other parts of the Pacific area.

Broader cooperation between the USSR and the Pacific countries can have a highly positive effect on branch structure and territorial location of their economies. Thus, it could contribute to accelerate development of the Pacific coast provinces of Canada. Looking into the future it could be possible to organize power-intensive industries on the basis of the cheap hydroelectric power resources of Siberia with Canadian and Australian raw materials.

Overall, economic cooperation between the USSR and the Pacific countries would certainly contribute to the development of regional ties, make them more stable and planned in nature, and would contribute to the democratic foundation of regional economic relations. Broad development of economic cooperation on the basis of strict adherence to the principles of equality and respect for each other's interests will make an important contribution to the further decrease of international tensions in this region, and will provide a material foundation for the process of establishing collective security by promoting further development of friendly and neighbourly

relations between the countries of the Pacific area.

SOVIET VIEWPOINT (2)
INTEGRATION TENDENCIES IN PACIFIC ASIA AND EXTERNAL ECONOMIC RELATIONS OF THE USSR

I. A. Lebedev

It is evident to any attentive observer today that in the western part of the Pacific Basin or in Pacific Asia, if we are to use the term coined by Japanese specialists to define the vast region adjacent to the Pacific Ocean from Japan to Indonesia and Australia, a new specific system of economic relationships with certain integration tendencies present is taking shape. Without going into details and without attempting to characterize this system, we would like to stress only that the concept of the transformation of Pacific Asia into a special area based on close economic links with and gravitating toward Japan has in recent years become a common one when economic trends in the region are analysed. Consideration of complex economic processes, including processes of integration, in Pacific Asia and still more in the Pacific as a whole does not come within the scope of this paper. Besides, these matters have already been discussed at the conferences on Pacific Trade and Development which were attended by some of the participants of the present conference. But it is worthy of note that the situation in the region, especially under the impact of the energy crisis, has undergone serious changes, and to come back to the issues already discussed, including problems of integration and integration tendencies, would be only natural and advisable. In the paper no more than an attempt is made to touch upon the prospects of the Soviet Union's, and first and foremost of Siberia's and the Soviet Far East's, participation in an evolving system of economic relationships in the Western part of the Pacific Basin as it appears to a Soviet specialist.

But before doing so it is advisable to focus attention on some general concepts concerning the place of the Soviet Union in the global economy and the possibilities of economic cooperation between the USSR and the capitalist world (there still exist a number of erroneous preconceived notions such as the USSR's alleged traditional preference for autarchy, etc.).

Soviet economists base their analysis of present-day international economic relations on the general concept of the global economy. The global economy has come into being as a result of economic development accompanied by deepening of international division of labour, growth of trade exchange between countries and their deeper involvement in mutual economic relations, with all this leading to greater interdependence of their national economies. This process was defined by V.I. Lenin as "internationali-

zation of economic life." Before the Socialist revolution in Russia and the emergence of the Socialist economic system there existed a single global capitalist economy. But the emergence of the socialist system (represented at first only by the Soviet Union) did not spell the end of the global economy. It is significant that V.I. Lenin in some of his works propagated the idea that after the socialist revolution Russia would remain within the framework of the global economy, exerting a revolutionising influence on the whole system of global economic relationships (by this is meant the influence contributing to the transformation of the global economy on a democratic basis, on a basis of independence and equality). Moreover the Soviet government headed by V.I. Lenin in the immediate postwar period (after the end of World War I and the Civil War in Russia) worked out a whole plan for the restoration of the global economy. The main components of the plan were:

--Combining efforts of Soviet Russia and other countries (with equal participation of the colonial peoples) in order to restore the global economy and the productive forces of Russia grievously affected by the War;

--enlisting cooperation of foreign companies and other bodies in the development and processing of natural wealth of Soviet Russia and in bringing Russia's raw materials into use for purposes of speedier economic development of the country and the restoration of the global economy suffering from scarcity of raw materials, this last being one of the consequences of the War.

Incidently, such a plan was put forward by the Soviet delegation to the Genoa conference in 1922. The statement of the Soviet delegation ran as follows: "In the current historical period, when the parallel existence of the old and the new social systems is a fact, the economic cooperation between the states representing these two different systems is of vital importance."

The existence of the two world systems does not mean, as some of the economists suggest, the end of the global economy. Being a complex, a sum total of national economies belonging to different economic and political systems and interrelated on a basis of international division of labour, the global economy as an objective reality could not have and did not vanish. But neither did it remain unchanged. A new global economy, within which the two world systems compete and cooperate with one another, came into being.

The two socially different world economic systems develop not in an autarchic way, a way of isolation, but in a way of interaction and interconnection. The pattern of this interaction between states with different economic systems is complex and contradictory. Competition and elements of struggle are dialectically interconnected, they coexist with relations of exchange and cooperation.

Problems of the expansion of international economic relations on a global scale have recently acquired special importance. In the beginning of the 1970's there occurred in international relations a turn towards detente. This brought about more favourable conditions for the growth of economic cooperation between the states of the two different systems and for their joint approach to solving the most urgent economic problems resulting from the scientific and technological revolution. In their turn, the international economic relations and economic cooperation now form an important integral part of the policy of consolidating international security. The Soviet stand on the necessity of broadening international economic cooperation was clearly formulated by the General Secretary of the CPSU Central Committee L. Brezhnev (in his speech at the World Congress of Peace Forces in October 1973): "Broad international division of labour is the only basis for keeping pace with the times and being abreast of the requirements and potentialities of the scientific and technological revolution. This, I should

say, is axiomatic today. Hence, the need for mutually beneficial, long-term and large-scale economic cooperation, both bilateral and multilateral. Of course, this applies not only to Europe but also to all continents, to the entire system of present-day international economic relations. Another reason why we advocate such cooperation is that we regard it as a reliable means of materially consolidating peaceful relations among states."

By this general position is determined the Soviet approach to the specific economic processes that develop in the western part of the Pacific Basin, to the new system of economic relationships evolving in that region. The Soviet Union stands for the expansion of equal and mutually beneficial trade and economic links with all the countries of the region.

Because the territory of the Soviet Union is so large there exists in its economic relations with the aforesaid countries one specific aspect: these relations are of special importance to Eastern Siberia and the Soviet Far East ("Pacific Siberia") and may in the future seriously affect the economic development of these regions of the USSR.

Soviet planning is based on the assumption that rational and economically effective development of any given region is possible only with due consideration paid to the concrete conditions of that region. For the eastern regions of the Soviet Union, rich in natural resources, such concrete conditions, apart from effective participation in regional division of labour within the country, consist in participation in international division of labour. It is for these regions that the the economic relations with the Pacific Basin countries are of paramount importance (it goes without saying that the other regions of the Soviet Union participate in these relation, the country as a whole acting in the sphere of external economic relations as a single unit).

It is but natural that the first place in economic relations between the Soviet Union and the Western Pacific countries is held by Japan. In the last five years the volume of Soviet-Japanese trade has approximately doubled (in 1972 it reached 815 million roubles; in 1973 about 950 million roubles). If, in order to make the general trend more evident, a longer period (1957-1972) is considered, then we see that trade turnover between the two countries in those years increased 50-fold. It is not these figures alone that are important (though admittedly, the actual volume of Soviet-Japanese trade is far below the possibilities of both countries; notwithstanding the fact that the rapid growth of this trade has made Japan one of the most important trading partners of the USSR, Japan's share in Soviet foreign trade only slightly exceeds 3 percent, while the Soviet Union's share in Japanese foreign trade amounts to only 2 percent, according to data for 1971) but the constant expansion of Soviet-Japanese trade.

Along with ususal trade transactions, it should be noted, an ever greater role in Soviet-Japanese relations in recent years is being played by economic cooperation. For a number of years the Soviet-Japanese agreements on cooperation in development of the timber resources of the Soviet Far East have been carried out (they provide for Japan supplying machinery and equipment on credit repayable in deliveries of timber; the first such general agreement has already been carried out).

The agreement on the delivery of Japanese-made equipment and on Japanese assistance in the construction of Vostochny port in Wrangel Bay has been operating successfully. Ten million tons of cargo will be discharged and shipped at the new port annually. The construction of Vostochny port is only a part of a whole programme of

building new ports and reconstructing and enlarging the old ones on the Pacific coast of the USSR. Obviously, it means further expansion of economic contacts not only with Japan but with other Western Pacific countries.

At present Soviet-Japanese talks on a number of large-scale joint projects for the development of natural resources of Siberia and the Soviet Far East on a mutually advantageous basis are in progress (these talks are in various stages; the general agreements on some of these projects have already been concluded). Among these projects are the following:

--The development of Southern Yakut coal deposits. The Soviet Union buys machinery, equipment and other goods for the big coal mining complex on credit repayable in coal deliveries over 20 years. The general agreement on this project was signed in Moscow on June 3 this year. Among other things, this agreement provides for a credit of 450 million U.S. dollars extended to the Soviet side by the Japan Export-Import Bank. This agreement is viewed in the Soviet Union as a beginning of large-scale and long-term cooperation between the two countries.

--Soviet-Japanese cooperation in prospecting and development of natural gas deposits in Yakutia. This project provides for supplies of Japanese equipment, first of all for prospecting and construction of gas pipe-lines, on credit in exchange for natural gas.

--The supply of Tyumen oil (from Western Siberia) to Japan. The Japanese side is expected to provide equipment for prospecting and development of the oil fields, for overland transportation of oil and tanker-loading installations on the Pacific coast. The Soviet side will supply oil to Japan over a period of 20 years, starting with 1981, first in gradually increasing quantities, and, from 1985 till 2000, at an annual rate of 25 million tons.

Mention should also be made about the project for developing Far Eastern timber resources. This project envisages Soviet deliveries of timber in exchange for Japanese equipment for timber mills, road-building machinery and machinery for building port installations.

It is worthy of note that the Soviet side has agreed to the participation of American companies in the realization of any of the above mentioned projects if the Japanese side wishes it.

Lately the Soviet Union has advanced some new suggestions on venues of long-term economic cooperation with Japan. For instance, the Soviet side proposed (and the Japanese side agreed) to explore the possibilities for the construction of a big cellulose mill in Eastern Siberia. Another Soviet proposal concerns the possibility of Japanese companies supplying Japanese equipment for atomic stations to be built on Sakhalin on credit repayable in subsequent Soviet deliveries of electricity to Japan. This proposal is under consideration by the interested Japanese companies.

An important step towards the realization of these large-scale projects was made when in April, 1974, the Soviet-Japanese intergovernmental protocol, which provides for the Japan Export-Import Bank lending 1,050 million U.S. dollars to finance Soviet purchasing of machines, equipment, building materials needed for the development of Southern Yakut coking coal deposits, prospecting of Yakut natural gas deposits and exploitation of timber resources of the Soviet Far East, was signed. Repayments will be made by the Soviet side in coal, gas and timber deliveries. The Soviet-Japanese arrangements for financing the Southern Yakut coal project and the conclusion of the general agreement on this project mentioned above are part of the practical implementation of this protocol.

As far as the Soviet Union is concerned, the realization of the above mentioned projects will contribute to further and speedier expansion of the economy of Siberia and the Far East and consequently to the growth of the Soviet economy in general.

The development of the economy of Siberia and the Soviet Far East will open broad opportunities for an expansion of Soviet-Japanese trade and economic cooperation. This development will increase resources available for export and will make it possible to satisfy to a greater extent Japan's needs in raw materials and fuels. Simultaneously it will contribute to an expansion of exchange of manufactured goods between these regions of the Soviet Union and Japan (and other Pacific countries). In its turn the wide-scale programme for the construction of chemical plants, oil refineries, textile mills, non-ferrous metals plants, paper mills, wood processing plants, oil and gas pipe-lines, railways and ports will result in a stable demand for a broad range of Japanese manufactured goods which it is economically more sensible for the USSR to buy in Japan rather than transport from the western regions of the Soviet Union, and in an expansion of demand for goods from other Pacific countries. For instance, the construction of the giant Baikal-Amur railway, running across areas of Eastern Siberia and the Far East rich in mineral deposits, will greatly increase the possibility of large-scale trade and economic relationships with foreign countries, particularly Japan and other countries of the Pacific Basin. It is significant that the Soviet press calls this new Trans-Siberian railway the "second road to the ocean." One cannot but stress in this connection that the possibilities for the overland transit shipments of goods (by the Pacific countries) across the Soviet Union to Europe and to Western Europe in particular will increase considerably.

Economic cooperation between the Soviet Union and Japan develops mainly on the basis of arrangements which Soviet economic literature calls compensation agreements or investment-production programmes. The Soviet state organs and economic organisations along with foreign companies, banks and state agencies take part in the implementation of compensation agreements. Compensation agreements (the above mentioned projects belong to this category) enable the Soviet Union to develop natural resources, certain branches of its national economy and some insufficiently developed regions. They make it possible to economize time and financial recourses by using long-term foreign credits which are repaid by exporting a part of the products produced at the new enterprises (plants, mines, etc.) built with these credits. The projects themselves remain in Soviet ownership and under Soviet management.

At the same time, and this must be stressed, large-scale compensation agreements (cooperation projects) come within the production sphere of the participating countries' economies. As far as the Soviet Union is concerned, one speaks not about separate and sporadic commercial deals with companies of the capitalist countries but about large-scale use of the whole complex of Soviet external economic relationships in the interests of the development of Soviet national economy. These relationships thus become an important component of the overall economic plan. Objective necessity for developing external economic relations is dictated by many factors, in the first place by transition to mass production which requires a large market, international specialization and the combining of resources of a number of countries. Inadequate distribution of natural resources also serves as a stimulus to expansion of external economic relations.

The most important feature of the economy of defeloped socialism as was stated at the XXIV Congress of the CPSU is the ecomplex cha-

racter of the economic solutions planned and realized. Long-term complex programmes (projects) form the basis of long-term plans in various industries and regions of the country. We have thus entered into a qualitatively new stage in the development of external economic relations, that of long-term forms of economic cooperation of the Soviet Union with foreign states. Compensation agreements (cooperation projects) occupy an important place among these forms of cooperation. Compensation agreements are a form of economic cooperation in conditions of peaceful coexistence, a form which is based on international division of labour and, resulting as it does in the growth of national incomes of two (or more) countries, is mutually advantageous.

At present the Soviet Union's involvement in an emerging system of economic relations in the West Pacific proceeds first of all along the line of expansion of large-scale and long-term economic relationships with Japan. Nevertheless the external economic relations of the USSR in the region are not confined to Japan (the assertions one meets with that Japan may come to dominate the Soviet Union's "Pacific" economic relations are entirely unfounded). There are, for instance, a number of opportunities for the development of contacts between the USSR and the other developed country of the region--Australia--and again not only along the line of expansion of mutual trade but along the line of economic cooperation. It is possible, for example, to visualize Australian participation in the development of timber resources of Siberia and the Soviet Far East in forms similar to those that have been evolved in Soviet-Japanese relations in this field. "Triangular" economic cooperation between the USSR, Japan and Australia might also prove promising.

Obviously, there exist ample opportunities for trade and economic cooperation between the Soviet Union on the one hand and Malaysia, Singapore (economic cooperation between the City-state and the Soviet Union has grown considerably in recent years), the Philippines and other countries of the region, including New Zealand, on the other.

An ever more active participation of the Soviet Union in an emerging system of economic relationships in Pacific Asia will in our view have the most positive influence on economic processes in the region and will contribute to their developing not according to a pattern of economic domination and dependence but to that of mutually beneficial cooperation in the interest of economic development and growth of living standards in all countries of the region.

As has already been stated above, the consideration of the processes leading to the emergence of a new system of economic relationships in the western part of the Pacific does not fall within the scope of this paper. The aim has been only to draw attention to the "Soviet factor" in these processes. An attempt has also been made to show that the Soviet Union's desire to develop in every possible way large-scale and long-term economic contacts with the countries of the other economic system is not a manoeuvre dictated by present-day expediency but a manifestation of the Soviet Union's general line in the sphere of relations with the countries of the other economic system, and to stress that this applies in full to the Pacific.

At the Second Conference on Pacific Trade and Development (Honolulu, 1969) an idea was voiced that the Soviet Union "will need to be brought into the orbit of any planning for the future of the Pacific Basin." This idea seems extremely timely in present-day conditions. Scholarly study, in a constructive spirit, of the possibilities for developing the economic ties between the USSR and the countries of the West Pacific can become a valuable contribution to

the development of mutually advantageous economic cooperation and one that will help bring about the strengthening of peace.

Comments on Yakubovsky's and Lebedev's Papers - Kiyoshi Kojima

I. Professor Yakubovsky and Lebedev present us with an excellent review of the growing economic potentials and trends in the direction of economic integration among Pacific Basin countries. Their presentation of the Russian viewpoint is a welcome addition to this conference. But what the participants of this conference really want to know is the Russian position, attitudes, and interests in Pacific economic cooperation. In other words, what is their evaluation of Russian policy towards economic cooperation. Professor Yakubovsky does touch on these issues briefly in the last part of his paper and Professor Lebedev does explain the Pacific Siberian resource development in detail, but their assessment of overall policy is vague.

I am most impressed to learn that Russian interests in participating in Pacific economic development and cooperation are very keen. Professor Yakubovsky states, "Success already achieved in the economic development of the Eastern regions of the USSR, as well as complex development of the economy of Siberia and the Far East, contribute to increasing overall economic potential of the Pacific area and create conditions for deeper participation of the Soviet Union in the international division of labour in the Pacific". Similarly, Professor Lebedev explains that the Russian principle is that "enlisting cooperation of foreign companies and other bodies in the development and processing of natural wealth of Soviet Russia's raw materials into use for purposes of speedier economic development of the country and the restoration of the global economy suffering from scarcity of raw materials, this last being one of the consequences of the war".

I see, as I am sure other participants would agree, Russia's utmost interest in the Pacific at present is natural resources development in Eastern Siberia and the Soviet Far East ("Pacific Siberia") and in this certainly Japan and United States and even other countries are keenly interested. But those gigantic projects are bound up in international political problems and I am not in a position to express any view on these questions. Particularly we are concerned with the Russian-Chinese relationship. We cannot neglect China's presence and interests. I do hope some comments on this point will be given by our Russian colleagues.

II. From an economist's point of view I would like to raise two questions on Pacific Siberian natural resource development. First, recently, developed countries' efforts to develop and import natural resources from developing countries have often been condemned and viewed as exploitation and new imperialism on the part of the developed countries. The Siberian development plans seem to fit this pattern. However, the Russian Professors obviously do not regard this development scheme as imperialistic or exploitative. Why not?

Secondly, I am much interested in what Professor Lebedev called "compensation agreements or investment-production programmes". Perhaps this is what we call the "production-sharing" method. There is a number of ways to promote economic development and technology transfer to developing countries, which is the main theme of this conference, for example, through foreign direct investment, produc-

tion-sharing, production and management contracts, licensing of know-how, etc. I would like to know more exactly what is the mechanism of the production-sharing method, as compared with other arrangements, its merits and demerits, and in what conditions it is applied most effectively.

III. Russia's other interests in the Pacific economic development and cooperation certainly involve other developing countries in the region. Professor Yakubovsky mentions Russia's "large-scale technological assistance provided to developing countries in construction of industrial transportation and agricultural enterprises." I would be most grateful if Professor Yakubovsky would explain more details of Russian technology assistance, especially how it differs from capitalist countries' transfer of technology and the reason why the Russian form is not "imperialistic".

IV. Lastly, I am not able to understand what Professor Yakubovsky means in the following: "In spite of a certain degree of industrial and economic development Asian countries again happen to be in the dependent position in the emerging division of labour because they develop labour and capital intensive industries, usually with an unfinished cycle of production, while head enterprises and science intensive industries remain in Japan and in other industrially developed capitalist countries". Eastern European countries do receive direct investment and joint ventures from Russia and Western countries. In this case, is there a special principle which is not discussed above? I am convinced that developing countries will be better off developing step by step from labor-intensive industries and from least technology-gap activities through the help of foreign direct investment and unpackaged transfer of technology, although which specific measures are preferable should be carefully examined.

3

DEVELOPMENT, TRADE AND TECHNOLOGY IN THE PACIFIC REGION
THE NORTH AMERICAN VIEWPOINT

GUSTAV RANIS

I

The panorama implied by the above title which the Conference organizers have bestowed upon me is terrifyingly broad. What is even worse, it is difficult to deal with these issues in the absence of at least some consideration of the broader global context within which Pacific Region developments are bound to take place. Finally, to round out the difficulties facing this intrepid author, we do not feel competent to present "the" North American viewpoint--if one exists. Thus, to avoid any misunderstandings at the outset, we must insist that we shall at best be able to deal with some selected dimensions of the factors affecting development, trade, and technology in this Region--and from the viewpoint of one North American observer.

That any consideration of economic relations among the coutries of the Pacific would be foolhardy in the absence of some assessement of the broader international economic context will appear especially obvious today at a time of substantial turmoil in international economic relations generally. Even since the last meeting of the Pacific Trade and Development Conference the nature of the international economic crisis has shifted and become more pronounced. Superimposed on such long-smouldering problems as stagnation in global trade liberalization and substantial fatigue in the North with the concern for development in the South, we have now had to contend with the oil crisis, rampaging global inflation, and, last but not least, the implicit threat of more North-South and North-North confrontations. There is the danger--in spite of some reassuring recent OECD noises--that advanced countries, not getting "their share" of the oil profits reflow, will try to solve their external problems by restrictions or competitive devaluations. In the euphoric aftermath of the, perhaps as yet all too short, experience with oil, more LDC's, smarting from neo-colonial concerns of longer standing, seem to be ready to test their market power in such other sensitive raw material areas as bauxite, copper, even bananas. Finally, the non-oil majority of LDCs is experiencing additional severe problems caused by rapidly rising petroleum and fertilizer prices, along with general inflation abroad. This is on top of their long term problem of substantial rural neglect plus distorted urban-industrial development patterns within, leading to unsatisfactory employment and distribution outcomes even in situations where overall growth has been fairly satisfactory.

It is thus fair to say that this Conference is meeting at a time when virtually everyone thinks he is facing serious short term as well as long term economic problems--with the possible exception of the OPEC countries--and even they are concerned with the possible breakdown of the international economic order and with where to invest their new found huge surpluses. In such a period of crisis there is a good deal of talk about "going it alone" i.e., autarky in trade, in investment and even in technology (and ideas), as domestic objectives seem to be threatened by external pressures and events.

Consequently, we see indeed many signs of disarray potentially affecting the setting for the Pacific Region and affecting its future in a substantial way. The Committee of 20 on international monetary reform has felt itself obliged to put off basic reform, trying to institutionalize the current chaos in relations among the rich, with a substantial moth-balling of the rest, at least for the time being. Prospects for any major new initiative in global trade liberalization--not to speak of initiatives directed toward the solution of North-South problems in trade or aid are, at this point, extremely limited. In fact, the best one can hope for at this moment is probably the avoidance of further back-sliding, especially, in this Region, by the hardest hit Northern countries, such as Japan.

But this new overlay of issues of a quasi crisis dimension, on top of the fundamental longer term problems which were in existence long before, also has its compensating aspects--mainly perhaps that of drawing attention to these very less ephemeral bed-rock issues which might otherwise continue to have gone ignored for some time yet. With all our moorings loose it is perhaps not too much to say that this is also a time for a substantial reexamination of relations between the North and South generally, and the countries of the North and South in the Pacific Region in particular. It may therefore be not only a time of travail and difficulty but also a time of substantial opportunity. Certainly substantial neglect of the problems of development, trade, and technology in this part of the world is much less likely today than it even was a short year ago. Not only is there a concern--probably exaggerated--about the shift in the secular trend of the terms of trade (no one noticed what happened to wheat and soya prices two short years ago) but also a more general--probably healthier--realization of the room for "doing mischief" by the developing countries who have long been more or less taken for granted. The threat of nuclear proliferation "on the cheap" raised by India's recent explosion of a nuclear device will probably reinforce this reassessment. Thus, while some of these feelings and fears may border on the hysterical rather than the historical, it is not at all clear--as is so often true in human affairs --that the present atmosphere of general crisis, instability and reassessment cannot be turned into an advantage, especially as far as the developing regions of the world are concerned. It is polyanna to assume that this will necessarily happen; but it is not too much to say that the chances have been somewhat enhanced (see the most recent U.S. "willingness to reconsider the link").

In discussing development, trade, and technology in the Pacific Region--with an eye to the future under conditions of possibly additional flexibility--we shall endeavor to first assess the present situation in the Region in an historical context (section II); then turn to the potential for the future in the context of some idealized vision (section III); and finally, conclude with some global, regional as well as country-specific suggestions for policy on the part of both the rich and the poor countries to move us in that direction (section IV).

II

Any discussion of the Pacific Region--past, present or future--should not, we believe, be conducted in terms of any monolithic North-South partitioning but must recognize the substantial diversity among both the DC's and LDC's represented in the Region. While we could, of course, extend this point to emphasize that there exists inherent diversity between any two countries, we shall content ourselves here with the more reasonable intermediate position of differentiating further among the developing countries in the Region by those major typological characteristics, which, we believe, affect the assessment of both the present and the potential for the future.

Turning to the developing countries of the Region, we must recognize, first of all, that there are no "least developed" countries--using the UNCTAD definition--in the area, nor, with the possible exception of Indonesia, are there any extremely rich economies represented.[1] Instead, there are basically two types of developing countries: type I, the relatively small labor surplus, human resources rich, natural resources poor variety, including South Korea, Taiwan, Singapore, Hong Kong, some already "graduated" or about to graduate from LDC status; and type II, the labor surplus natural resources rich type represented by the Philippines, Indonesia, Thailand and Mexico. One could further differentiate, in this latter group, between those with fairly substantial entrepreneurial strength and industrial experience, such as the Philippines and Mexico, and the others in which the human resources basis is still somewhat less fully developed.

Similarly, there can be said to exist two types of developed countries in the Region, the relatively mature land and capital rich economies of the U.S., Canada, Australia and New Zealand, on the one hand, and the more recent graduate into modern growth, emerging from its own prior labor surplus state--Japan. Again, a further subdivision between the U.S. and Canada, the more technologically advanced industrial DC's, on the one hand, and Australia and New Zealand, the relatively more agriculturally oriented DC's, might prove helpful but will not be pressed.

Any attempt to assess development, trade, and technology patterns in the countries of the Pacific Region must be embedded in the historical context within which these countries have been operating, at least for the last quarter century. Turning, first, to the developing countries, this period (with a somewhat earlier start in Mexico) has marked the first sustained effort at national development. If we view the development problem as essentially one of attempted transition between a long epoch of agrarian stagnation and an equally long epoch of modern growth, such transitions may last--if history is any guide--from 30 to 50 years. Moreover, they are likely to be composed of important sub-phases during which the major development and trade characteristics of the system undergo substantial change, i.e., a first sub-phase of primary or consumer goods import substitution, followed by either a secondary or capital goods import substitution sub-phase, or by an export substitution sub-phase.

Little time need be spent here in elucidating the nature of these sub-phases of transition. Once LDCs, in the wake of political independence, gained full control of their critical traditional raw material export earnings, these were reallocated, along with domestic saving, towards domestic industrial and overhead expansion. The policy tools used were typically exchange controls and licensing,

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1) Even in Indonesia, oil hardly begins to swamp the economy as it does, say, in Kuwait or Saudi Arabia.

increasingly overvalued exchange rates, low interest rates and credit rationing, plus domestic terms of trade rigged in favor of the industrial sector. Both the type I and type II LDC's in the Region (with the exception of Hong Kong, which is the most special of special cases and immediately opted for export orientation) moved vigorously into primary import substitution industrialization in the early post-war. Such regimes do, however, run out of steam sooner or later--mainly because the size of the domestic market is limited. This point was essentially reached by the mid 50s in Mexico, the Philippines, and Thailand; by the late 50s and the early 60s in Taiwan, South Korea and Singapore; it has not yet been reached in Indonesia. One relevant index is the rapidly declining proportion of total consumer good supplies imported.

The differential response to this gradual exhaustion of the possibilities for continued "easy" import substitution as between the type I and type II LDC's in the Pacific Region is both remarkable and instructive. In Taiwan, South Korea, and Singapore, as is well known by now, primary import substitution, fuelled by land intensive exports, was followed by export substitution, fuelled by labor intensive industrial exports. Once entrepreneurial experience had sufficiently matured and infrastructural construction sufficiently progressed, these countries embarked upon a gradual "opening up" of their economies to trade, through a combination of policy changes including devaluation, interest rate reform, liberalization of imports, improvement of domestic agriculture's terms of trade, etc. In consequence, the production and export structure of these economies underwent rather remarkable change as the industrial sector was called upon to begin to provide the fuel for its own future growth. Raw material or land intensive exports gave way to a dramatic increase in labor intensive industrial exports penetrating international markets on a competitive basis (see Table I, contrasting 1960 and 1970), as the total trade orientation of the economy soared.

As a consequence of this successful transition from primary import substitution to export substitution, the type I subset of Pacific Region LDC was thus extremely successful during the 60s and into the early 70s, not only in terms of domestic growth performance but also in alleviating the underemployment problems plaguing labor surplus economies and in avoiding a worsening distribution of income as well. In fact, these systems were able to reallocate labor sufficiently rapidly so that they have moved out of labor surplus and into a labor shortage condition.[2] Their production and export structure has become increasingly technology and even capital intensive in recent years.

It should, moreover, be noted that, contrary to some frequently expressed views, the outstandingly good performance of Taiwan, while certainly benefitting from access to the U.S. market for industrial consumer goods, cannot be written off as a simple case of heavy foregin capital inflows; in fact, foreign aid and foreign private capital together accounted for only 6 percent of the total investment between 1952-54 and 1967-69; the rest was generated via the balanced contribution of domestic agriculture, and industry.[3]

What is interesting for the type I LDC in the Region, then, is that the policy choice of moving to export substitution when primary import substitution gave out, facilitated by the early mobilization

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2) This undoubtedly true for all type I cases, with the possible exception of South Korea. The record of achievement in these cases has been well documented elsewhere and need not be repeated here. See papers by Balassa, Fei and Ranis, Helen Hughes, and others.

of the agricultural sector, permitted successful graduation from developing economy status via the full, dynamically changing, exploration of the opportunities for international trade, related to the selective mobilization of advanced country technology and its adaptation to a labor surplus context. A sustained period of export substitution, with industrial sector labor absorption proceeding at a rate substantially ahead of population growth did permit the labor surplus reservoir to be exhausted and the dualistic nature of the economy to be eradicated. While the brute act of saving and the role of turn-key technology was more important during the primary import substitution sub-phase, the role of appropriate or adaptive technology in its relation to radically changing output mixes in penetrating international industrial markets became extremely important during the export substitution sub-phase. This is indicated by a declining industrial capital-labor ratio in Taiwan's manufacturing sector during this period, as well as the many evidences of labor-using technology change at the micro level, in the export processing zones and elsewhere.[4]

Turning now to the type II LDC's in the Pacific Region, they can be said to have made a different choice at the end of their primary import substitution sub-phase, i.e., they, by and large, moved into secondary import substitution. For example, both the Philippines, Mexico and, to some extent, Thailand can be said to have moved into import substitution in the areas of durable consumer goods, capital goods, and raw materials processing, as domestic markets for non-durable consumer goods became exhausted.

This attempt to prolong import substitution, characteristic of many LDCs on a global basis, can be related to the availability of a sufficiently favorable natural resources base to permit the continued fuelling of an ever more costly and inefficient production structure on an inward looking domestically oriented basis. In other words, you have to be able to afford it--either because of traditional exports which are finding favorable and secure markets (right now mostly minerals), or via the search for new export commodities, such as bananas in the Philippines or tourism in Mexico. Especially when the terms of trade seem to be shifting in favor of the natural resources rich LDC type, it is possible to maintain essentially the old policy package, that of substantial protection and orientation towards the domestic market by continuing to favor the domestic entrepreneurial industrial class at the expense of food producing agriculture, as well as industrial exports. However, even in these cases, the costs of continuing to fuel the industrialization process via land based exports is likely to rise over time (see the Philippine case where this has been empirically demonstrated)[5] so that, after a point, the terms of trade deteriorate rather badly for the industrial sector not only in terms of the inability of domestic agriculture to continue to provide the essential food and savings for continued industrialization but also in terms of the increasing resort to food imports. The capital goods and raw materials required to maintain the secondary import substitution momentum must be purchased at a higher and higher total resource

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3) This is in contrast to the case of South Korea where agricultural development was relatively neglected, agricultural savings played a much smaller role and foreign capital consequently had to provide more than 60% of total investment over a similar period. Singapore and Hong Kong are of essentially less interest from a developmental point of view since they represent somewhat atypical city-states without an agricultural hinterland.

4) See the author's "Industrial Sector Labor Absorption," Economic Development and Cultural Change, April, 1973.

5) See Sharing in Development: A Program of Employment, Equity, and Growth for the Philippines, ILO, 1974.

Table IA EXPORTS OF PACIFIC

	U.S.A.	Canada	Japan	Aust-ralia	N. Zealand	DC's in Pacific Region	Mexico
U.S.A.		3,689.5	1,554.2	329.1	79.8	5,652.6	892.2
Canada	2,943.3		178.9	65.1	24.1	3,211.4	38.0
Japan	1,106.6	110.4		91.3	21.6	1,329.9	17.9
Australia	167.0	30.6	296.3		63.0	556.9	7.0
N.Zealand	108.8	10.8	26.4	40.2		186.2	0.2
DC's in Pacific Region	4,325.7	3,841.3	2,055.8	525.7	188.5	10,937.0	955.3
Mexico	703.1	21.0	2.5	4.6	0.0	731.2	
S. Korea	3.6	0.0	20.2	0.0	0.0	23.8	0.0
Hong Kong	127.0	14.9	38.9	20.0	5.8	206.6	0.0
Philippines	284.1	1.3	131.6	0.9	0.2	418.1	0.0
Taiwan	18.1	1.2	59.8	0.2	0.0	79.3	0.0
Indonesia	175.0	2.2	30.2	28.2	0.3	235.9	2.8
Singapore	80.5	16.4	52.2	45.2	18.0	212.3	1.2
Thailand	48.0	0.2	61.0	0.5	0.0	109.7	0.0
LDC's in Pacific Region	1,439.4	57.2	396.4	99.6	24.3	2,016.9	4.0
Rest of the World	9,248.9	1,382.1	2,039.3	1,412.8	496.1	14,579.2	275.8
Grand Total (World)	15,014.0	5,280.6	4,491.5	2,038.1	708.0	27,533.1	1,235.1

Source: Yearbook of International Trade Statistics, U.N. Department of Economic

Table IB EXPORTS OF PACIFIC

Exports to / Exports from	U.S.A.	Canada	Japan	Aust-ralia	N. Zealand	DC's in Pacific Region	Mexico
U.S.A.		9,491.9	5,564.7	1,141.4	161.3	16,359.3	1,567.5
Canada	10,578.2		762.6	177.7	50.6	11,569.1	91.5
Japan	6,015.5	557.1		576.3	122.5	7,271.4	86.0
Australia	598.6	132.4	124.9		245.6	1,101.5	13.0
N.Zealand	207.7	41.1	120.0	97.7		466.6	1.9
DC's in Pacific Region	17,400.0	10,222.5	6,572.3	1,993.1	580.0	36,767.90	1,759.9
Mexico	846.8	45.3	68.9	4.8	0.4	966.2	
S. Korea	390.6	19.6	234.3	2.9	5.4	652.8	0.4
Hong Kong	896.7	68.7	177.6	70.0	19.7	1,232.7	6.3
Philippines	441.9	2.7	419.2	4.2	0.3	868.3	0.02
Taiwan	400.9	39.5	157.6	15.5	0.0	613.6	1.4
Indonesia	119.7	0.01	251.7	61.4	0.7	434.5	0.1
Singapore	172.2	18.6	118.1	52.3	5.2	366.4	6.7
Thailand	92.7	0.7	180.0	3.1	0.6	277.1	0.1
LDC's in Pacific Region	3,361.5	195.2	1,607.4	214.2	32.3	5,129.3	15.0
Rest of the World	19,190.1	2,930.8	10,703.0	2,275.2	625.3	35,724.4	685.8
Grand Total (World)	39,951.6	13,348.5	18,882.7	4,482.5	1237.6	83,349.4	2,460.7

Source: Yearbook of International Trade Statistics, U.N. Department of Economic

COUNTRIES 1960 (Million U.S. $)

S.Korea	Hong Kong	Philip-pines	Tai-wan	Indo-nesia	Singa-pore	Thai-land	LDC's in Pacific Region	Rest of the World	World
133.7	120.0	255.3	108.2	122.6	52.0	64.2	1,748.2	12,957.2	20,358.0
2.3	19.6	13.8	2.9	1.6	4.6	2.1	84.9	1,965.5	5,261.8
70.4	158.2	159.5	102.2	83.0	99.3	96.0	786.5	1,938.5	4,054.9
6.0	23.1	7.0	3.6	8.0	35.3	4.7	84.7	7,409.1	2,050.7
0.0	1.1	2.2	0.0	0.0	2.2	0.2	8.9	645.9	848.0
212.4	322.0	437.8	216.9	215.2	193.4	167.2	2,702.2	18,916.2	32,573.4
0.0	0.0	0.4	0.0	2.1	2.5	0.0	5.0	58.5	794.7
	2.7	0.0	0.4	0.0	0.4	0.1	3.6	4.4	31.8
5.6		1.2	13.3	25.7	49.4	23.6	118.8	330.9	656.3
9.0	0.6		2.9	0.2	2.3	0.1	15.1	127.2	560.4
5.9	19.6	1.8		0.0	3.6	4.1	35.0	56.2	170.5
0.7	15.2	29.0	0.0		174.8	11.2	233.7	380.9	840.5
0.1	20.3	1.2	1.2	10.1		28.0	62.1	854.6	1,159
0.1	29.0	0.1	2.8	13.7	38.0		83.7	227.7	421.1
21.4	87.4	33.7	20.6	51.8	271.0	67.1	557.0	2,060.4	4,634.6
95.3	567.9	132.3	71.0	307.4	894.8	243.6	2,588.1	199,230.7	216,398.0
329.1	977.3	603.8	308.5	574.2	1,359.2	477.9	5,865.1	220,207.3	253,606.0

and Social Affairs.

COUNTRIES 1970 (Million U.S. $)

S.Korea	Hong Kong	Philip-pines	Tai-wan	Indo-nesia	Singa-pore	Thai-land	LDC's in Pacific Region	Rest of the World	World
584.1	382.3	354.9	292.5	157.7	266.1	192.8	3,797.3	23,067.4	43,224.0
23.2	20.3	21.0	15.2	2.2	13.4	9.6	196.4	4,419.4	16,180.9
809.3	691.0	369.1	537.0	262.8	476.3	485.9	3,717.4	8,430.4	19,319.2
13.7	71.0	56.4	36.5	24.7	111.2	40.9	267.4	3,252.4	4,621.3
5.4	6.2	0.3	0.0	0.5	1.5	5.4	21.3	714.7	1,202.6
1,435.7	1170.8	801.7	881.2	447.9	868.5	734.6	7,999.8	39,884.5	83,349.4
1.0	1.8	1.6	8.4	0.2	13.4	1.2	27.6	211.6	1,205.4
	27.6	1.1	4.9	2.7	11.0	5.0	52.7	129.7	835.2
16.6		16.0	19.0	46.1	101.8	24.2	230.0	1,051.6	2,514.3
41.7	12.0		14.5	1.6	7.2	3.2	80.2	1,112.2	1,059.7
23.2	93.1	15.2		12.7	27.2	30.2	203.0	433.4	1,250.0
19.8	26.1	29.5	6.4		140.7	19.2	241.8	124.3	799.6
13.5	59.1	4.5	10.3	49.1		12.6	145.8	1,041.4	1,553.6
1.8	52.2	0.4	31.6	16.0	45.3		147.4	260.7	685.2
117.6	271.9	68.3	95.1	128.4	346.6	105.6	1,148.50	3,463.9	9,903.0
430.0	1462.4	340.4	190.2	315.8	1,245.9	453.2	5,123.7	213,899.5	254,747.6
1,983.3	2905.1	1,210.4	1,415.8	892.1	2,461.0	1,293.4	14,421.8	250,229.0	348.000

and Social Affairs.

cost, as food deficits become commonplace in countries which have a substantial potential for agricultural productivity gain. Of course, if demand conditions in international trade are sufficiently favorable, such a policy can presumably be maintained for a long time; certainly no one would question the ability of an oil rich country such as Venezuela to move along this path for some decades to come without any major problem as far as growth is concerned. However, it is increasingly clear that, even here, there may be a "fly in the ointment," i.e., the emerging problems of distribution and lack of employment absorption in the labor surplus context may become socially and politically intolerable even when a substantial, in fact quite high, growth rate can be indefinitely maintained. The recent reversal in the terms of trade has probably been overstated, especially if we take as our base a period preceding the global wheat, soya, and rice shortage and take into account what has been happening to the price of industrial good imports. But even if we admit that the type II LDC's in our Region are relatively well endowed and are benefitting from current raw material price trends, this advantage is likely to be, at best, short-lived, and their ability to maintain this pattern of growth indefinitely, limited.

Thus, an important question is whether or not the relatively natural resources rich labor surplus economy like that of Mexico or the Philippines really has as much of an advantage over the natural resources poor labor surplus economy as might be imagined. More resources should presumably always be better than less, certainly in negotiating a difficult transition from one policy regime to another--since no one would doubt that finance ministers and central bankers are likely to be more ready to consider such shifts when foreign exchange receipts are rising and a dependable foreign demand for cash crop traditional exports seems to be in the offing. Yet there exist perversities in the affairs of man which cannot be discounted. We all know that reforms represent a problem in political economy; and the contrast between Taiwan and the Philippines may at least suggest that a natural resources rich developing country, while more able, may also find itself less willing to effect the necessary painful policy changes--largely because it is not "up against it." Especially at a time when raw material prices are on the upswing, there is a very natural human temptation to avoid the unpleasantness which is associated with the withdrawal of protection, the elimination of windfall profits, the lowering of the temperature generally for the groups favored during the import substitution regime. A quarter century of protectionist habits, paternalism and centralization in government, neglect of the rural hinterland, and all the rest that we have come to associate with sustained periods of import substitution, are not easily broken. To the extent policy makers feel that nature has seen fit to be permanently kind to them, as the terms of trade have finally moved to their "rightful" or "fair" place, they will be more reluctant to confront vested interests in both the private and the public sectors and expose society to the vagaries of a more competitive growth regime. Under such circumstances the odds are overwhelmingly for a continuation of the present pattern of development, which, if foreign demands for new raw materials indeed continue strong, may ensure continuation of substantial growth but can be expected to be accompanied by conditions of deepening dualism, underemployment and income maldistribution in the type II LDC's of the Region.

If the (likely) choice is made to continue import substituting into technologically ever more difficult and more capital intensive areas, the consequences may be predicted on the basis of the recent past. If we take, for example, the case of Mexico, the export/GDP ratio has been declining steadily, especially since 1950 when import

substitution controls became more direct and pronounced. This ratio which is one measure of an economy's participation in the world economy, stood at 10 percent in 1950 and fell to about 3 1/2 percent by 1970. Contrast this with Taiwan which went from 11 percent in 1953 to almost 30 percent in 1970. Note also that capital intensity in Mexico's industrial sector is rising steeply, with a virtual doubling of the capital/labor ratio during the same period--partly due to the increasingly modern imported technology adopted, as the distortion of relative factor prices continues, and partly due to the shift in the output mix towards the ever more capital intensive and technology intensive sectors. Meanwhile, the industrial sector labor absorption rate is about 1/3 that experienced under an export substitution regime and the unskilled labor surplus condition persists and is probably worsening.

In the Philippines the same general phenomenon can be observed. Overall industrial capital intensity has been increasing, both due to output mix and technology changes--and industrial goods continue to account for only around 8 percent of total exports in 1970 (Table III). The export/GNP index did not decline but held more or less steady at around 15 percent between 1950 and 1972, indicating the absence of any transition to exports substitution, but a perhaps less severe case of inward oriented secondary import substitution than in Mexico which started its industrialization earlier. (In fact, the ratio of consumer goods imports to total imports in the Philippines has kept on declining until 1970, indicating that a good deal of "easier" or primary import substitution was still going on through the 1960s.)

Thus we have here the phenomenon of increasing unemployment and a worsening distribution of income,[6] side by side with an increasingly capital intensive industrial sector, all fuelled by more or less traditional cash crop exports. Moreover, food producing agriculture is lagging badly and food imports are becoming an additional burden on the foreign exchange requirements of the economy instead of food exports helping to finance further industrialization, as in the case of Taiwan.

Indonesia finds itself in a somewhat different situation. Subject to run-away inflation, food shortages and a generally deteriorating economic situation during the Sukarno period, she has during the last 7 to 8 years made substantial economic progress but can be said to still find herself very much within the primary import substitution sub-phase of transition. Whether or not she will choose to move in the direction of export substitution or continue on the path of secondary import substitution is not yet clear--although the anticipation of substantial oil revenues over the next few decades and a consequent strengthening of the control-oriented forces in the government are clearly an important ingredient in determin-

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6) In Mexico, in 1950 the poorest 40 percent received 14.3 percent of total income; by 1969 they received 11 percent. In the Philippines, the poorest 20% received 4.5% of total income in 1956; by 1971, they received 3%. Regional distortions have similarly worsened. The inflow of short-term capital from the U.S. and the Euro-Currency market is being increasingly resorted to in the case of both Mexico and the Philippines. The publicized portion of Euro-Credits to the Philippines reached $587 million in the first quarter of 1974 and that to Mexico (which receives more than 70% of its capital from the U.S.) $535 million. While some of this is undoubtedly influenced by the oil crisis--especially in the case of the Philippines--an examination of the balance of payments of these type I Pacific LDC's indicates an increasing reliance on shorter-term capital inflows over the past few years.

Table IIA PERCENTAGE SHARE OF

	U.S.A.	Canada	Japan	Australia	N.Zealand	DC's in Pacific Region	Mexico	S.Korea
U.S.A.		18.12	7.63	1.61	0.39	27.76	4.38	0.66
Canada	55.94		3.40	1.24	0.46	61.03	0.72	0.04
Japan	27.29	2.72		2.25	0.53	32.80	0.44	1.74
Australia	8.14	1.49	14.45		3.07	27.16	0.34	0.29
N.Zealand	12.83	1.27	3.11	4.74		21.96	0.02	0.00
DC's in Pacific Region	13.28	11.79	6.31	1.61	0.58	33.58	2.93	0.65
Mexico	88.44	2.64	0.31	0.58	0.00	91.97		0.00
S. Korea	11.32	0.00	63.52	0.00	0.00	74.84	0.00	
Hong Kong	19.35	2.27	5.90	30.05	0.88	31.48	0.00	0.85
Philippines	50.69	0.23	23.48	0.16	0.03	74.61	0.00	1.60
Taiwan	10.61	0.70	35.07	0.12	0.00	46.51	0.00	3.46
Indonesia	20.82	0.26	3.59	3.35	0.03	28.06	0.33	0.08
Singapore	6.94	1.41	4.50	3.90	1.55	18.32	0.10	0.01
Thailand	11.40	0.05	14.48	0.12	0.00	26.05	0.00	0.02
LDC's in Pacific Region	31.06	1.23	8.55	2.15	0.52	43.52	0.09	0.46
Rest of the World	9.05	1.35	2.00	1.38	0.49	14.28	0.27	0.09
Total	14.83	3.83	2.95	1.49	0.62	23.74	0.58	0.02

Source: Yearbook of International Trade Statistics, U.N. Department of Economic

Table IIB PERCENTAGE SHARE OF

Exports to / Exports from	U.S.A.	Canada	Japan	Australia	N.Zealand	DC's in Pacific Region	Mexico	S.Korea
U.S.A.		21.96	12.87	2.64	0.37	37.85	3.62	1.35
Canada	65.36		4.71	1.10	0.31	71.48	0.56	0.14
Japan	31.14	2.88		2.98	0.63	37.64	0.44	4.19
Australia	12.95	2.86	2.70		5.31	23.83	0.28	0.30
N.Zealand	17.27	3.42	9.99	8.12		38.80	0.16	0.45
DC's in Pacific Region	20.87	12.26	7.88	2.39	0.69	44.11	2.11	1.72
Mexico	70.25	3.76	5.71	0.39	0.03	80.15		0.08
S. Korea	46.77	2.35	28.05	0.35	0.65	78.16	0.05	
Hong Kong	34.59	2.73	7.06	2.78	0.78	49.03	0.25	0.66
Philippines	41.70	0.25	39.55	0.40	0.03	81.94	0.00	3.92
Taiwan	32.07	3.15	12.63	1.24	0.00	49.09	0.11	1.86
Indonesia	14.97	0.00	31.48	7.68	0.09	54.21	0.01	2.48
Singapore	11.08	1.20	7.60	3.37	0.33	23.58	0.43	0.87
Thailand	13.53	0.10	26.27	0.45	0.08	40.44	0.01	0.26
LDC's in Pacific Region	33.94	1.97	16.23	2.16	0.33	51.79	0.15	1.19
Rest of the World	7.57	1.15	4.22	0.90	0.25	14.08	0.27	0.33
Grand Total (World)	12.42	4.65	5.55	1.33	0.34	23.95	0.35	0.24

Source: Yearbook of International Trade Statistics, U.N. Department of Economic

EXPORTS OF PACIFIC COUNTRIES 1960

Hong Kong	Philippines	Taiwan	Indonesia	Singapore	Thailand	LDC's in Pacific Region	Rest of the World	Grand Total
0.59	1.25	0.53	0.60	0.25	0.31	8.59	63.65	100.0
0.37	0.26	0.05	0.03	0.09	0.04	1.61	37.35	100.0
3.90	3.93	2.52	2.04	2.45	2.37	19.40	47.81	100.0
1.13	0.34	0.17	0.39	1.72	0.23	4.13	68.71	100.0
0.13	0.26	0.00	0.00	0.26	0.02	0.69	76.17	100.0
0.99	1.34	0.66	0.66	0.59	0.51	8.35	58.07	100.0
0.00	0.05	0.00	0.26	0.31	0.00	0.63	7.36	100.0
8.49	0.00	1.26	0.00	1.26	0.31	11.32	13.84	100.0
	0.18	2.03	3.91	7.53	3.59	18.10	50.42	100.0
0.11		0.52	0.03	0.41	0.02	2.69	22.70	100.0
1.49	1.05		0.00	2.11	2.40	20.53	32.96	100.0
1.81	3.45	0.00		20.79	1.33	27.80	45.32	100.0
1.75	0.10	0.10	0.87		2.41	5.36	76.32	100.0
6.89	0.02	0.66	3.25	9.02		19.88	54.07	100.0
1.88	0.73	0.44	1.12	5.85	1.45	12.02	44.67	100.0
0.56	0.13	0.07	0.30	0.88	0.24	2.54	83.17	100.0
0.48	0.41	0.12	0.61	0.84	0.31	3.38	72.88	100.0

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EXPORTS OF PACIFIC COUNTRIES 1970

Hong Kong	Philippines	Taiwan	Indonesia	Singapore	Thailand	LDC's in Pacific Region	Rest of the World	Grand Total
0.88	0.82	0.68	0.36	0.61	0.45	8.78	53.37	100.0
0.13	0.13	0.09	0.01	0.08	0.06	1.21	27.30	100.0
3.58	1.91	2.78	1.36	2.46	2.51	19.24	43.64	100.0
1.54	1.22	0.79	0.53	2.41	0.88	5.79	70.38	100.0
0.52	0.2	0.00	0.04	0.12	0.45	1.77	59.43	100.0
1.40	0.96	1.06	0.54	1.04	0.88	9.60	47.85	100.0
0.15	0.13	0.70	0.02	1.10	0.09	2.29	17.56	100.0
3.30	0.13	0.59	0.32	1.32	0.59	6.31	15.53	100.0
	0.64	0.75	1.83	4.05	0.96	9.15	41.82	100.0
1.13		1.37	0.15	0.68	0.30	7.57	10.49	100.0
7.45	1.22		1.02	2.18	2.42	16.24	34.67	100.0
3.26	3.69	0.80		17.60	2.40	30.24	15.55	100.0
3.80	0.29	0.66	3.16		0.81	9.38	67.04	100.0
7.62	0.06	4.61	2.33	6.61		21.51	38.05	100.0
2.74	0.69	0.96	1.30	3.50	1.06	11.59	26.62	100.0
0.58	0.13	0.07	0.12	0.49	0.18	2.02	83.90	100.0
0.72	0.30	0.36	0.23	0.45	0.20	2.84	73.21	100.0

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ing the outcome.[7)]

With the exception of the smaller type I countries in the Region, it may thus be said that the developing countries in the Pacific are still fairly heavily engaged in import substitution, either through the use of direct or indirect controls, i.e., QR's or the use of adjustable tariff cascading; that they are basically importers of advanced technology with relatively little domestic innovative capacity and little adaptive technological change in evidence, that they are suffering from increasing capital intensity in their industrial sectors, along with unemployment and income distribution problems; that their agricultural sectors, especially food producing agriculture, have been relatively neglected and discouraged

Table III SECTORAL GROWTH OF EXPORTS OF THE

	1960						1965			
	Agriculture		Non-Agriculture		Total		Agriculture		Non-Agriculture	
	Value	% of Total Export	Value	% of Total Export	Value	% of Total Exports	Value	% of Total Export	Value	% of Total Export
U.S.A.	7,061.5	34.6	13,296.5	65.4	20,358.0	100.0	8,778.5	39.9	18,224.8	60.1
Canada	2,950.8	56.1	2,311.0	43.9	5,261.8	100.0	4,234.0	52.5	3,830.5	47.5
Japan	437.1	10.7	3,617.8	89.3	4,054.9	100.0	625.6	7.4	7,826.8	92.6
Australia	8,960.7	15.6	90.0	4.4	2,050.7	100.0	2,336.4	80.1	581.7	19.9
N.Zealand	811.0	95.7	37.0	4.3	848.0	100.0	931.8	94.6	54.5	5.4
Sub Total for DC's in PacificRegion	13,221.1	40.5	19,352.3	59.5	32,573.4	100.0	16,906.3	35.7	30,518.3	64.3
Mexico	580.5	73.0	214.5	27.0	795.0	100.0	874.8	78.7	237.7	21.3
S. Korea	27.3	85.9	4.5	14.1	31.8	100.0	68.0	38.8	107.1	61.2
Hong Kong	116.0	17.7	540.3	82.3	656.3	100.0	134.0	12.4	452.3	87.6
Philippines	540.1	86.4	20.3	3.6	560.4	100.0	724.9	91.3	68.9	8.7
Taiwan	130.8	76.7	39.7	33.3	170.5	100.0	258.7	57.4	191.4	42.6
Indonesia	787.4	93.7	58.1	6.3	840.5	100.0	703.7	99.4	4.0	0.6
Singapore	844.3	72.9	314.7	27.1	1,159.0	100.0	597.5	59.7	74.7	40.3
Thailand	420.4	99.8	0.7	0.2	421.1	100.0	356.9	58.8	250.2	41.2
Sub Total for LDC's in PacificRegion	3,446.8	74.4	1,187.8	25.6	4,634.6	100.0	3,718.5	62.6	2,215.4	37.4
Grand Total for Pacific Region	16,667.9	44.8	20,540.1	55.2	37,208.0	100.0	20,624.8	38.6	32,733.7	61.4

Source: Yearbook of International Trade Statistics, U.N. Department of Economic

and that their production and trade pattern has consequently not changed very dramatically.

Tables I, II, and III demonstrate the contrast in the recent historical path of the type I and type II LDC's in the Pacific Region. We need only look at a few indicators to make our point. South Korea's and Taiwan's total exports rose at an annual rate of 38.7 percent and 22.0 percent respectively during the 1960's contrasted with 9.8 percent for Mexico and 6.5 percent for the Philippines (Table III). But even more interesting is the breakdown into agricultural and non-agricultural exports, and the astounding 64 percent and 37 percent non-agricultural export growth rates for South Korea and Taiwan, contrasted with 15.9 percent and 14.8 percent

PACIFIC COUNTRIES (All values in million U.S.$)

1970								Average Annual Growth Rates (1960-1970)	Average Annual Agricultural Growth Rates (1960-1970)	Average Annual Non-Agricultural Growth Rates (1960-70)
Total		Agriculture		Non-Agriculture		Total				
Value	% of Total Exports	Value	% of Total Export	Value	% of Total Export	Value	% of Total Exports			
Value										
27,003.3	100.0	15,575.9	36.0	27,648.1	64.0	43,224.0	100.0	7.7	8.2	7.6
8,064.5	100.0	6.342.6	39.2	9,842.3	60.8	16,184.9	100.0	11.9	7.9	15.6
8,452.4	100.0	1,006.3	5.2	18,312.9	94.8	19,319.2	100.0	16.9	13.9	17.6
2,918.1	100.0	3,311.3	71.7	1,310.0	28.3	4,621.3	100.0	8.5	5.3	30.7
986.3	100.0	1,064.7	88.5	137.9	11.5	1,202.6	100.0	3.5	12.6	14.0
47,424.6	100.0	27,300.8	32.8	56,048.6	67.2	83,349.4	100.0	9.8	7.5	11.3
1,112.5	100.0	265.9	22.0	939.5	78.0	1,205.4	100.0	4.2	-8.1	15.9
175.1	100.0	188.5	22.6	646.7	77.4	835.2	100.0	38.7	21.4	64.4
1,086.3	100.0	167.6	6.7	2,346.7	93.3	2,514.3	100.0	14.4	3.8	15.8
793.8	100.0	978.8	92.3	80.9	7.7	1,059.7	100.0	6.5	6.1	14.8
450.1	100.0	313.2	25.0	936.8	75.0	1,250.0	100.0	22.0	9.1	37.2
707.7	100.0	768.3	96.0	31.3	4.0	799.6	100.0	-0.6	-0.2	-5.4
1,001.3	100.0	1,076.0	69.3	477.6	30.7	1,553.6	100.0	2.9	2.4	4.2
607.1	100.0	555.4	81.1	129.8	18.9	685.2	100.0	5.0	2.8	68.6
5,933.9	100.0	4,113.7	41.6	5,889.3	58.4	9,903.0	100.0	7.9	1.7	17.3
53,358.5	100.0	31,414.5	33.7	61,837.9	66.3	93,252.4	100.0	9.6	6.5	11.7

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for Mexico and the Philippines, respectively. An interesting contrast at the micro level is presented by the comparative performance of the garment industry, a very labor intensive activity.[8] In 1963, the Philippines exported $25 million of garments compared to $5 million for South Korea and $10 million for Taiwan. By 1971 the Philippines total was $36 million, while South Korea exported $294 million and Taiwan $374 million. The export substituting countries in the Region, in other words, expanded their total by leaps and bounds, in spite of quota restrictions abroad, while the still import substituting Philippines failed at times to even fill half her quota for cotton-based garments in the U.S. and faced no quota restrictions on synthetics. Moreover, while type I LDC exports to the U.S. and Japan were large and increased very rapidly, it should be noted (Table II) that a substantial percentage of Taiwan's total exports went to other LDC's in the Pacific Region, as contrasted to only 2 percent to 8 percent, of a much lower total, in the case of the Philippines. This gives testimony to the increased ability during export substitution to not only penetrate DC but also neighboring LDC markets, a feature often lost sight of in discussions of the potential for this kind of activity, if simultaneously adopted by a large number of LDC's. As trade liberalization takes place, it takes place not only with respect to the rich countries to which most of the exports, traditional and non-traditional, have historically been directed but also with respect to LDC's, and especially if they are also growing vigorously (for the same reasons).

We must, of course, take care to distinguish between "export substitution" as we have witnessed it in the cases of South Korea and Taiwan and "export promotion" as it has been encountered in Mexico and the Philippines. As we have seen in Table III, there has indeed been a substantial increase in the industrial exports of both the Philippines and Mexico in past years--even if the export orientation and the export growth rate, and the shift of composition from traditional to non-traditional, are all much less pronounced than in the Taiwan case. Industrial exports are generally recognized as a "good thing" these days and are rising. Export orientation has become fashionable in the developing world even where import substitution policies remain in force. Nevertheless when we look a little more closely at the nature of these exports, we find that there is a substantial difference between industrial export growth resulting from greater competitiveness of the domestic economy through liberalization, and the "pushing out" of exports through outright subsidization. In Mexico as well as, to a certain extent, in the Philippines the recent modest growth of industrial exports has been accomplished in large part by government pressure, often quite direct, forcing companies to export a certain percentage of total output regardless of price competitiveness. If, due to the maintenance of protection and inefficiency, sales below cost are required in such cases, this is accomplished via an official subsidy or, more frequently, the implicit understanding that losses on the export front are to be made up through the guaranteed continued enjoyment of non-competitive profits in the protected domestic market. Such "showing of the flag" is especially noteworthy in the case of automobiles in Mexico and cement in the Philippines and represent a form of activity more properly labelled "export

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7) The prospective strength of indigenous entrepreneurial capacity, especially relative to the Chinese minority, represents another important dimension of the problem.

8) Wearing apparel, excluding footwear and embroideries. For more details see Sharing in Development: A Programme of Employment, Equity and Growth for the Philippines, ILO, Geneva, 1974

promotion" rather than "export substitution" of the more natural, organic type. There should be no doubt that while the pendulum has globally swung towards export orientation in recent years, the pursuit of exports "at any price" can be just as costly in terms of failing to reflect an economy's changing resource endowment over time as the pursuit of import substitution. Examples of negative value added at international prices may one day be just as abundant in the case of exports.

Finally, a comparative note on the role of factor mobility in the type I and type II LDC's of the Pacific Region. With respect to the movement of capital there has been a substantial flow from the rich to the poor countries, shifting from bilateral aid to a greater emphasis on multilateral aid and, finally, during the most recent period, private capital. Table IV indicates this change in pattern in the total outflows from the rich countries of the Pacific Region to all LDC's--superimposed on the relative overall dec-

Table IV THE FLOW OF LONG-TERM FINANCIAL RESOURCES TO L.D.C.'s
(Million U.S.$)

	TOTAL (Official& Private)	PRIVATE	O F F I C I A L		
			Bilateral	Multi-lateral	Total
U.S.A.					
1964	4759.6	1297.0	3188.0	274.6	3462.6
1968	5723.0	2116.0	3355.0	252.0	3607.0
1972	7574.0	4029.0	2920.0	625.0	3545.0
Average annual % growth rate (1964 -1972)	6.4%	26.3%	-1.0%	15.9%	0.3%
CANADA					
1964	156.9	29.2	111.3	16.4	127.7
1968	307.6	93.6	171.4	42.6	214.0
1972	1015.4	409.3	452.4	153.7	606.1
Average annual % growth rate (1964 -1972)	68.4%	162.7%	38.3%	104.7%	46.8%
AUSTRALIA					
1964	126.8	20.0	101.3	5.5	106.8
1968	208.5	48.7	147.1	12.8	159.8
1972	421.9	145.6	258.6	18.0	276.3
Average annual % growth rate (1964 -1972)	29.1%	78.5%	19.4%	28.4%	19.8%
JAPAN					
1964	303.8	188.1	106.2	9.5	115.7
1968	1029.8	351.5	597.7	80.6	678.3
1972	2725.4	1257.9	1008.8	458.7	1467.5
Average annual % growth rate (1964 -1972)	99.6%	71.1%	106.2%	591.1%	141.1%

Source: Yearly Reviews (1964 to 1973) of "Development Cooperation". DAC/OECD

line of the U.S. role and the relative overall increase of that of Canada and Japan. The better the development performance of the LDC the more pronounced the shift, and the larger the volume.

The main carrier of private foreign capital has, of course, been the multi-national corporation. As expected, the wholly owned subsidiary has been the natural manifestation of the multi-national corporation phenomenon during the import substitution sub-phase--partly because of the inequality of domestic and foreign entrepreneurial capacity and bargaining power in that phase and partly because the brute act of saving and "getting things started" may indeed be among the more important contributions in the bundle of services available. At this point in time the role of relative prices, efficiency and the search for "appropriate technology" are essentially put aside in order to ensure as rapid a rate of industrial growth as possible. On the other hand, once export substitution gets under way, i.e., in the type I countries, there is a natural tendency to shift in the direction of more flexibility, joint ventures and other forms of local participation. At this point the role of appropriate technology and output mixes in penetrating international markets becomes much more necessary and important. There is much argument, and a growing literature, on the pros and cons of the MNC, including its role in technology transfer and adaptation. We can certainly conceive of a productive combination of the advantages of the MNC, with its global scan of markets and technology, and the now more mature domestic capacity based on the specificity and pecularities of the local resource endowment, institutional factors and markets. Sometimes, corporate "rules of thumb" and exaggerated worries about quality effects have to be overcome. During export substitution, the MNC presence in the form of joint ventures seems to make increasing sense, as there is a larger need for coming up with the right amalgam of imported and adaptive technology to ensure the continued competitive expansion of industrial sector activities. There seems to be some tendency in this direction. For example, for Asia as a whole the percentage of new investments of multinational corporations which were wholly owned, while still the predominant pattern, declined from 66 to 61 percent between 1957 and 1967 while joint ventures increased from 16 to 26 percent during the same decade.[8a)] Data were not available to distinguish between the type I and type II cases, but we would certainly expect the trend to be more pronounced in the former.

As far as labor is concerned, it is a well recognized fact that there remain important asymmetries in the vigor with which different aspects of resumed factor mobility in the Pacific Region are pushed. In fact, the DC's, while arguing more and more vigorously for the liberalization of capital flows, have become, if anything, more restrictive on the entry of, especially unskilled, labor. A second observation is that type I countries seem to be exporting more of their labor through commodity exports while type II LDC's find themselves under greater pressure to let more of the labor surplus migrate directly, e.g., Philippine "guest workers" in Guam. Finally, political factors aside, type I LDC's seem to have had less of a problem in losing their trained manpower, via the brain drain, than type II LDC's. As we would expect, the transition from primary import substitution to export substitution, rather than to secondary import substitution, provides not only greater domestic employment possibilities for the unskilled labor surplus but also greater mobility, flexibility and opportunity for its higher talent manpower.

8a) Multinational Corporations in World Development, United Nations, New York, 1973.

As far as the DC's are concerned, there is, in evidence, as we have already noted, a large dosage of uncertainty, instability and soul-searching at the present time in all of the countries concerned. The U.S., in particular, something of a pace-setter through most of the post-war period, in trade liberalization, in foreign assistance and in the revival of private capital movements--especially via the MNC--seems to have run out of economic initiatives. It cannot, of course, avoid taking positions on all of the major issues affecting the Pacific Region since it is "the" major Pacific power, but it has been in a largely defensive mood, responding to its own balance of payments problems, concentrating on the "unfair" trade practices (non-tariff barriers) of the Common Market, or repairing the breakdown of the international monetary system, along with, more recently, energy and oil. Surely there is, given domestic circumstances, a fairly liberal trade bill under discussion; surely also some concern with the LDC's in and outside of the Region manages to survive in the form of foreign assistance (bilateral and multi-lateral), investment guarantees and some half-hearted attempts to increase the scope for adjustment assistance and, possibly, global preferences. But, all in all, the past (almost) decade has witnessed a U.S. pulling back from economic as well as political involvement. Import restrictions of the tariff and quota variety, along with voluntary export restrictions exacted by explicit or implicit threats have become mere commonplace; unions and even international businesses have become more protectionist; official assistance, especially outside of such "security areas" as South-East Asia (and the Middle East) has plummeted; and there seems to be a general boredom with the problems of the developing world in general--if admittedly somewhat less pronounced in the case of the Pacific Region LDC's with many of which, especially Mexico, the Philippines, Thailand, South Korea and Taiwan, the U.S. maintains some sort of a "special relationship." Only its concern for MNC survival and prosperity abroad seem to have gone on undiminished on a global basis.

As Helen Hughes pointed out at last year's Conference,[9] while the DC's in the Region remain absolutely less protectionist than the LDC's, their trend is worse--i.e., there has been more liberalization and reduction of tariff cascading among the LDC's.[10] Canada, Australia and New Zealand, like the U.S., have become more seized with their own internal problems and those attending their relations with each other and Western Europe under conditions of rampant inflation, oil crisis and balance of payments pressures. Japan, which had been gradually opening up its highly protected domestic economy to imports and foreign investment--and had begun to substantially enlarge its foreign assistance program--has found itself most affected, in real terms and psychologically, by the most recent global events and is currently undergoing a searching reevaluation. This reevaluation has no doubt been compounded by the increasingly tender feelings South-East Asia has been demonstrating with respect to the inflow of Japanese private capital-not so different from Mexico's feelings vis-a-vis the U.S. Thus, while

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9) "Trade and Industrialization Policies: The Political Economy of the Second Best" in Structural Adjustments in Asian Pacific Trade, K. Kojima, editor, The Japan Economic Research Center, 1973, p.95.

10) The DC effective rate of protection against LDC industrial products has undoubtedly risen, especially if all the real and psychological non-tariff barriers could be "added in" (for an earlier assessment see B. Balassa, "The Impact of Industrial Countries' Tariff Structure on Their Imports of Manufactures from Less Developed Areas," Economica, Nov. 1967).

none of the DC's in the Region seem to be in anything approaching an heroic mood, but are rather more interested in retrenchment or, at best, stability in their relations with LDC's, there also exists a painful awareness that the development problem is not likely to go away--moreover that LDC's may have an increasing capability to inflict pain on their Northern partner if mutually satisfactory solutions are not found.

Nevertheless over the longer haul, as a comparison of Tables IIA and IIB reveals (note the "blocked" cells) there has been an increased "regionalization", at least of trade, among the countries examined. Whether we are considering the exports from and to Pacific DC's (which rose from 33 percent to 44 percent of total exports during the decade) or the exports from LDC's to the DC's of the Region (which rose from 44 percent to 52 percent of the total), there has been a substantial increase in the natural or "organic" interaction among the countries of the Region.[11] The reasons for this may perhaps be found, in part, in the reduction of the importance of Commonwealth preferences but also in the underlying natural complementarities that do exist in the Region.

III

We have by no means managed--nor really tried--to summarize in any rigorous, coherent fashion the basic current conditions among the various main actors in the Region--or how they got there. Nevertheless we must now press on to make some equally general but hopefully suggestive comments as to what the future may hold in relation to Pacific development, trade and technology patterns. Nor are we in any position--or have any desire--to make projections or even predictions as to what is actually going to happen. Rather, we shall indicate what potentially may happen in an idealized sense based on what we conceive to be some of the underlying economic and non-economic features of the current and prospective situation in the Region--and gloablly, as it affects the Region.

We do not, first of all, expect any major strides towards new global solutions which would favorably affect the Pacific Region in the near term. By that we mean that no brave new major initiatives in restructuring North-South or even North-North economic relationships can be counted upon--either in the field of trade or the movement of capital or technology. Nor do we franky believe that great strides can be expected in terms of purely regional "solutions" or improvements. It is quite possible (though not likely) that ASEAN, for example, will become a more viable focus for pragmatic regional or sub-regional solutions to the problems of minimum scale, multilateral payments etc. The LDC's in the Region do have a considerable amount of homogeneity in per capita income combined with heterogeniety in resource endowment--cettainly as between the type I and type II representatives--all favorable to common market or free trade solutions. But we would nevertheless tend to agree with Miguel Wionczek[12] that, based on the accomplishments of the past in this area, no great strides can be expected in the near future. As the Andean

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11) The only exception is trade among the Pacific LDC's which has stayed about constant. On this general subject, see also Donald R. Sherk, "The Tendency Toward Regionalism in the Pacific Trade Basin," The Developing Economies, September, 1969.

12) "Latin American Growth and Trade Strategies in the Post-War Period" in Structural Adjustments in Asian-Pacific Trade, op.cit., p.211.

Pact indicates, some things can be accomplished in forging policies, e.g., vis-a-vis the multinational corporation, on a regional basis--as long as the objectives are not too ambitious and there is provision for sufficient flexibility and escape clausing.

But this relatively restrained view of the possibilities for global or regional initiatives in the Region does not inhibit one from seeing the possibilities for substantial mutually beneficial improvement in the patterns of development, trade and technology in the years ahead. With each of the major countries in the Pacific Region acting in a responsive, if self-interested fashion, substantial improvements in welfare can, we believe, result from more natural or organic regionalization.

Let us take the prospective pattern of production and trade in the Region, for instance. If we could construct a dynamic scale of comparative advantage we could dimly see the following type of pattern unfolding in our Region--under optimistic assumptions with respect to individual country actions:

1) The Type I LDC's would continue to "climb up" the technology intensive ladder of production for world markets, "chasing" Japan, for example, out of electronic component manufacturing as they previously chased her out of electronic assembly and, earlier, out of textiles, wigs, and toys. In 1955, to cite but one example, Japan provided 55 percent of U.S. textile imports; by 1965 this had fallen to only 29 percent. Increasingly Japan can be expected to move into the more capital and high technology intensive areas--e.g., the export of capital goods out of which she can be expected to "chase" the U.S. and Canada (as well as Germany, etc.). The problem of Taiwan and South Korea will increasingly become one of gradual agricultural mechanization to avoid too rapid a rise in wage costs--combined with the training of high skilled manpower and the avoidance of politically-caused brain drain. Since they are basically resource poor countries, we would expect them to become net importers of food in the future--once domestic agriculture has fulfilled its historical mission--from such places as Australia and New Zealand, as well as the U.S. and Canada.

2) The type II LDC's in the Region would, first of all, ensure that their own agricultural hinterlands are mobilized for development. The requirements for such balanced rural growth are paramount in such countries as Mexico, the Philippines, Thailand and Indonesia, since, without it, the export oriented traditional or industrial activities cannot be expected to make a real dent on the severe employment and income distribution problems--and even on the ability to sustain past levels of per capita income growth. In most of these countries there exists a large potential for labor productivity increase in food producing agriculture through technology change of the seed/fertilizer variety--assisted from abroad as in the case of the short-lived "Green Revolution" but much more sustained via country-based adaptive research and non-agricultural rural growth in infrastructure and rural industry.[13] The mobilization of the rural sector is important, moreover, for the successful participation of these countries in international trade on a continuous, flexible and efficient basis. The Philippines and Mexico, for example, have a tremendous opportunity, along with Thailand, to almost immediately step into the labor intensive industrial production and export lines just being vacated by the type I countries who are "suffering" from the rapidly rising real wage levels which accompany the end of labor surplus. All natural fears concerning the reduction of long

13) This is too big a subject to be detailed in the context of this paper. See, however, Sharing in Development: A Program of Employment, Equity, and Growth for the Philippines, ILO, 1974, op.cit.

standing habits or protection to the contrary, Mexican and Filipino producers are ready to engage in large-scale natural export substitution rather than the small-scale and costly export promotion now being practiced. Brassiere manufacturers in Mexico's border industries, for example, exposed to a more competitive international market environment, are in a position to undersell domestic producers serving the protected internal market--in spite of the substantial transportation cost and the loss of tariff benefits that would be involved.[14] Type II LDC's with somewhat less pronounced entrepreneurial strength, such as Indonesia, may have to wait a little longer, but can already test the waters via the use of export processing zones in which both domestic firms and MNC's can be asked to participate.

The potential for such international subcontracting by process, e.g., in electronics, leather goods, gloves, etc. seems to be substantial; it has been growing by leaps and bounds and now constitutes more than 1/6 of total U.S. imports from the LDC's. Their rejection or at least bad press in labor surplus LDC's is somewhat puzzling and undoubtedly related to the customary predominance of MNC's. While such export platforms have relatively small spill-over effects, it should be recalled, however, that they may ease the transition from import substitution to export substitution; moreover, these are enclaves which do not exploit irreplaceable natural resources (as in the case of the minerals of an earlier day) but absorb otherwise unemployed and thus permanently lost human resources.

3) As far as the DC's in the Region are concerned, their contribution to developemnt via official foreign assistance to the LDC's of the Region is likely to decline even further in relative importance from its present levels. Most of the LDC's have either already "graduated" to economic maturity (type I) or are sufficiently natural resources rich so as not to require much capital assistance. The only exception to this might be the necessity of some temporary "aid ballooning" in type II developing countries to assist with the real or psychological transition problems of moving from an import substitution to an export substitution policy package. The same thing would hold for the need for a diversification fund in relation to any real free trade zone or common market initiative in the Region. In both instances increasing use of such regional institutions as the Asian Development Bank to minimize inevitable frictions arising from performance criteria, surveillance, etc. might be considered.

The main foreseeable contribution of the DC's in the Region to development must, however, reside in permitting maximum, politically feasible, access to DC domestic markets for the products of export substitution in the course of Pacific Region LDC import liberalization and gradual decontrol. This means, realistically, a substantial effort in adjustment assistance in all the DC's, but especailly the U.S. and Japan. Any "foreign aid" funds reallocated and acutally spent at home to ease the economic and political pains of domestic employers and workers are bound to be substantially more productive.

Japan whose pollution and congestion problems continue to weigh heavily just below the surface of current concerns will want to persevere in moving towards the high technology, brain-intensive and "clear" range of products described in the 1971 White Paper on International Trade and Industry--and away from industrial goods now more efficiently producible in, say, Singapore, and agricultural goods much more cheaply available in Australia and New Zealand. The gradual dismantling of the protective controls over DC domes-

14) Author's interview data.

tic agriculture, while politically the most difficult, has also progressed the most in recent years, e.g., in the U.S. and will hopefully continue.

Finally, with respect to the related issues of the international movement of capital and technology, certain actions on the part of both the rich and the poor countries are required if international flows and choices are to be rationalized. The most sensitive issue in this area is, of course, the role of the multinational corporation which has given rise to more polemical discourse and less analysis than virtually any subject of concern to us here.

If we attempt to disaggregate the various functions of foreign investment, the roles of capital and management are probably most important during the import substitution phase, yielding to entrepreneurship and technological adjustability in export substitution, and gradually terminaing--after graduation from labor surplus--in the flow of portfolio capital, supplemented by occasional management contracts and licenses to transfer specific proprietary knowledge. This could be seen as the "final" manifestation of an MNC presence in the interplay among now mature countries--along with the movement of capital in response to differences in the rate of return. We would expect such interactions to be a continuing flexible feature of the international movement of capital and, needless to add, of labor--accompanying multilateral trade on both final and intermediate products.

Unfortunately both parties don't always as yet understand that the advantage to the LDC of a full bundle of MNC activity, say via the wholly owned subsidiary, which may be considerable in the beginning, is likely to diminish over time. On the part of the MNC there has thus been a clear reluctance to move towards joint ventures, licensing, etc. as host LDC entrepreneurial capacity matures and the pure contribution to saving assumes a lesser importance. On the part of LDC's there similarly is often a desire to retain import substitution controls long after their rationale has lost its force but, as the MNC mystique declines, large MNC profits are noted, and nationalistic resentment increases, to attempt to turn the temperature down only for the foreign investor. This is likely to be due to a mutual misunderstanding of the predictable dynamics of an ideal relationship over time. The bargains struck initially in the early import substitution phase are almost bound to guarantee the MNC an extremely high rate of return, based in substantial part on the public grant of monopoly position, which it is later loathe to surrender. The LDC, for its part, initially wants the MNC presence largely for prestige, bandwagon and security reasons, almost regardless of the terms--and often on terms much in excess of what it would take to attract it. Neither party has anticipated the inevitably changing nature of the basic relationship--if they are to continue to coexist and benefit in some mutually agreeable fashion. Moving from presnt reality to a somewhat idealized, but nevertheless not hopelessly naive view of what is feasible in the future is consequently most difficult in this area, perhaps the most sensitive of all in terms of future relations between the rich and poor countries in the Region.

IV

There are a number of things, within the realm of the possible, which should be considered for policy option both by the rich and the poor countries in the Region if we are to move somewhat closer to the ideal. None of these proposed actions are in the category of global solutions of an heroic type but rather in the nature of

more modest steps that seem feasible in the present environment in the Region with respect to trade, technology and development.

Turning first to the LDC's, we have already referred to the need for further liberalization of the foreign trade regimes in the developing countries of the Region, especially in the type II representatives. Such liberalization for countries moving toward export orientation should, of course, include exchange rate adjustment where appropriate, and adjustment assistance to its own entrenched older industries which may be threatened by a gradual change in the environment. More action on these fronts and less concern with either foreign aid, on the one hand, or preferences extended by the rich partners, on the other, would be in the interest of both the growth objectives and the achievements of a better distribution and employment outcome for the developing countries in the Region. Neutral protection for all industry both of the import substitution and export oriented variety would be a possibility as an immediate step in the present situation. The establishment of export processing zones similarly would help to convince skeptics that the new regime could, in fact, have a substantial pay off for all dimensions of development. It is especially important that the type I developing countries of the Region, which have themselves benefitted so much in the past from their own liberalization measures in both foreign exchange and capital markets, not revert to protectionism as they graduate to maturity, e.g., as Japan did in earlier days, but to ungrudgingly make room for new emerging competitors in areas which they must ultimately vacate. The question is usually one of how big a struggle and how long it takes.

With respect to the movement of private capital, we would strongly argue for a more realistic and pragmatic attitutde on the part of LDC's, hand in hand with the unbundling of the MNC package into its component parts and a much more explicit examination as to just what is being transferred and being paid for and at what price at each stage of the development process.[15] Many misunderstandings arise simply because the so-called "powerful foot-loose MNC's bargaining with the weak optionless LDC's" is pressured to buy what is essentially a "pig in a poke." LDC's instead of competing with each other with respect to income tax holidays and other incentives of a fiscal variety bestowed on foreign enterprise, should coordinate on the kind of screening procedures which are objective, impersonal and "continuous", i.e., avoiding all-or-nothing acceptance or rejection. Fade-out and diverstiture agreements can similarly be negotiated much more intelligently ab initio in the light of some historical perspective which might provide, for example, for a transition from wholly owned subsidiary to joint venture after 10 years and possibly further reassessments in the direction of licensing or management contracts thereafter.

We must, of course, contend with the argument that "it is unlikely that multi-national firms will ever be willing to repeat the Japanese experience elsewhere because, from their point of view, they helped create formidable competition to themselves for very meager returns."[16] Clearly, if offered more at every stage they will seek more. But if there is a clear and anticipated transition from one function (and one bundle) to another within a particular LDC, competitive pressures among the MNC's should assert themselves to dictate a willingness to accept reasonable rates of return. In

15) See also Carlos F. Diaz-Alejandro, "North-South Relations: The Economic Component," Growth Center Discussion Paper No.200, April 1974, who argues for arms' length relationships.

16) Larry Krause, "The International Economic System and the Multinational Corporation," Annals of the American Academy of Political and Social Science, September 1972, p.99.

this we would be safer in relying on the MNCs' long-run profit maximization objectives rather than on some public spirited impulse.[17]

Automaticity moving towards greater flexibility over time is clearly desirable in all dimensions of North-South relations. Such procedures should reflect a recognition that some of the excesses of the MNC, ranging from transfer pricing to the payment of unduly high wages, to the inappropriateness of the technology selected, to the underutilization of patents and the overutilization of domestic credit and export prohibition clauses, are not unrelated to the import substitution policy environment created by the LDC's for all industry. The MNC can be most effectively forced to put its energies into building better mousetraps, and using adaptive (labor intensive) technologies in doing so, if it is forced to give up the "quiet life" of the satisficing monopolist as the transition to a more liberal policy regime is effected. MNC's are quite capable of coming up with appropriate technology and output ideas when there are pressures to "scratch around" further, witness the above cited experience in the export processing zones and the labor intensive multi-purpose Ford and GM vehicles, using simple sheet metal, jigs and fixtures, currently being produced in South-East Asia.[18]

Some of the windfall profits created through protection, subsidization, etc. are, of course, necessary to compensate entrepreneurs for undue risks during the necessary period of early import substitution. Even "old" MNC subsidiaries have learning and institutional problems to overcome. There are advantages, however, even then, in working for some harmonization among neighboring LDC's to avoid being played off one against the other, on the one hand, and granting concessions far in excess of what is required to effect the move, on the other. Moreover, where the major "advantage" of the MNC is trademark recognition in a low technology area, with domestic producers threatened by displacement and domestic consumers by demostration effects, screening procedures should restrict entry. Removal of the veil of secrecy and full disclosure requirements thereafter would constitute a giant step in the direction of avoiding unnecessary frictions. Much of the present problem is one of perception and mutual suspicion causing secular love/hate rather than arm's length business-like relationships.

Finally, the performance of the past decades indicates that, even under non-optimal conditions, the LDC's in the Region have managed to grow rapidly; the type I sub-set have, moreover, absorbed their unemployed labor surplus and, in at least the Taiwan case, even improved the size distribution of income. Thus an important element of success for the LDC's in the Region is to not let export pessimism, vis-a-vis each other due to the unfamiliarity of these new trading partners, or vis-a-vis the rich countries of the Pacific as well as of the rest of the world, influenced by actual and prospective trade restrictions--deter them from following pragmatic, gradually liberalizing policy trends in their own interest. The alternative of increasing autarky has some superficial attractiveness, e.g., through the improvement of performance as a consequence of "self reliance", but in the long run is bound to incur higher costs in achieving a set of development targets, or likely to make it utterly impossible to meet them--especially those concerned with distribution.

17) As Henry Ford II put it recently: "A corporation can serve society only if it is profitable. And it can stay profitable only if it is responsive to the [changing] needs....of the society in which it operates." (material in brackets and underlining added).

18) As a Ford executive put it (William O. Bourke, "Basic Behicle for South East Asia," in Technology and Economics in International Development, AID Seminar, May 1972, p.75) "simplicity is often harder to achieve than sophistication"--but it can be achieved when the motive is there.

The DC's in the Region, again acting not through global mechanisms, but pragmatically, each in their own interest, of course also have an important contribution to make in moving the Pacific Region closer to the naive vision we have presented. Turning, first of all, to trade, there is little need to emphasize the oft-repeated comment that opening up of the internal markets of the rich, through their own trade liberalization, coupled with a meaningful adjustment assistance program, would constitute the single most important act of assistance to the complementary poor countries of the Region, as well as at the same time assisting the welfare of the citizens of the DC's. Most of the LDC's in this particular Region are ready for major participation in world trade--unlike in other regions--and the worst possible lesson for an LDC is to watch another being "slapped down" by import restrictions as soon as it becomes successful in the international market for industrial goods.

The DC's can also do much on the capital and technology side. We have already commented on the fact that the developing countries in this Region do not belong to the least developed category and are therefore less likely to be recipients of concessionary foreign assistance in a major way. It is nevertheless important for Pacific Region DC's to move away from the image of a knee jerk reaction in favor of MNC citizens abroad--right or wrong. Hickenlooper and Gonzales amendments are viewed as only slightly modernized versions of gunboat diplomacy, and are equally ineffective. The U.S. has made no major effort in recent years to get rid of these and other well encrusted barnacles on the body of vintage 1961 aid legislation. The extension of domestic anti-trust and Trading With the Enemy legislation and other forms of extra-territoriality to U.S. MNC's abroad represents, in general, another ineffective and highly offensive instrument. Similarly the administrative practice of public sector aid tying sets an unfortunate example for intra-MNC movements of capital, both adversely affecting the LDC's choice of technology.

Closely related is the issue of OPIC-type government investment guarantees. There would seem to be little reason to provide MNC's quasi-automatically with DC subsidized specific or extended risk guarantees on the basis of financial criteria only. Any MNC investment thus guaranteed by the DC carries with it the implied blessing of the rich country; it is incumbent on the DC to satisfy itself that no unfair trade practices, exclusive market demands, export prohibition clauses or other objectionable procedures are being contemplated before any guaranty is extended.

Instead DC's, should, if requested, be willing to support LDC efforts to move out of import substitution and into export-oriented growth regimes. It is often substantially easier to overcome both vested interests and honest doubts concerning an impending import liberalization, for instance, if temporary aid ballooning is feasible to protect exchange reserves and public revenue positions in the transition. On the technical assistance side, donors should assist efforts to beef up LDC legal and economic staffs in order to deal more effectively--and on a more equal footing--with their large and powerful MNC counterparts. International assistance with research on adaptive industrial technology (see the analogies to rice and wheat research) as well as in providing greater market access and information to all parties on an equitable basis could also be of considerable help. But the main point on aid is that relatively little is needed, that DC's should wait to be approached and use as much multi-lateral channeling, e.g., via the ADB, as seems feasible.

An important aspect of liberalization with respect to factor mobility as a corrollary to commodity trade is a gradual relaxation

or, more realistically, a reversal of the trend toward restrictionism in the countries of the Region. Immigration policies with respect to unskilled labor in particular in the DC's have been hardening of late. This trend should at a minimum be halted, if not reversed. It is difficult to convince LDC's in this Region or elsewhere about the merits of free capital movements in the absence of a more forthcoming attitude on migration. On the other hand, with respect to the migration of skilled labor from poor to rich countries, a more responsible attitude on the part of the rich consistent with minimum intervention, is indicated. For example, acceptance of an export tax of the kind, unfortunately first employed by the Soviets on Israel-bound Jews, is not a bad way to ensure some return on scarce resources invested in human capital formation in these countries.

In summary, the Pacific Region is currently being buffeted by strong winds of change--especially as they affect the sphere of trade, technology and development. This could lead to increased autarky both as between rich and poor and as between rich and rich --and even as between the type I and type II less developed countries. It is especially at this time, however, that it is important to resist succumbing to crisis analysis and to try to keep one's eye on the underlying historical features of the situation. This would tend to make one rather more optimistic with respect to future performance of the Region. It is a relatively rich region, well endowed in terms of both its DC and LDC components. Secondly, it is a region with substantial diversity in resource endowment both as among the LDC's, e.g., Indonesia and Taiwan, and among the DC's, e.g., the U.S. and Japan. Thirdly, foreign aid, having fulfilled its function in the past, especially that of easing the transition from one growth regime to another in the type I cases, could be used in a similar, selective way in the future if the occasion arises. With that exception, it is the opportunities in trade, and the prospect for private capital movements, both equity and (increasingly) portfolio, which are likely to be important. We have noted the marked trend toward organic regionalism in the past, even in the presence of substantial obstacles to trade plus asymmetries and misunderstanding on factor movements. Given some historical perspective, a better understanding of what is pragmatically feasible,--and perhaps (even) better policies on the part of both the DC's and LDC's in the Region--we have no reason to be despondent about the future.

4

TRANSFER OF TECHNOLOGY AND JAPANESE EXPERIENCE*

SABURO OKITA AND SHUJI TAMURA

Introduction

In the world's long history of industrialization, the transfer of technology has played an important role in the establishment of new industry in many countries. In the eighteenth century, the industrial revolution of Britain spread rapidly to the continent. But it was not a natural phenomenon but a result of intensive effort to transfer technology and establish new industry in the national economy of each European country by the leadership of the government, state or entrepreneurs.

Through the process of technology transfer, relations in trade, transportation, and communication between countries have been greatly strengthened. The evolution of international trade is still going on, showing a tendency to shift from the early phase of trade in commodities to trade in capital and technology. Thus it is quite important to evaluate the effect of technology transfer from the standpoint of trade and development, because it is technology which generates and creates economic activities in both domestic and international markets.

During the 1960s, along with the surge of nationalism and movements seeking economic and political independence in the developing countries, there was a growing awareness of the importance of international cooperation which is based to a large extent on effective transfer of technology. In 1969 the Pearson report was presented to the World Bank calling for the importance of developing human abilities to adopt and create necessary technology.

Transfer of technology is not as easy a deed as the purchase of commodities. The technology itself involves in many such factors systematically related to production as raw materials, energy, machinery, and labor and management. In addition, the effectiveness of the transfer of technology is highly influenced by the social and economic condition of a recipient country as well as the characteristics of the technology itself and the choice of it.

For this reason, it would be meaningful to analyze how and under what condition a specific tenchnology was transferred from other countries. The real value would be realized only when such experi-

* The authors wish to akcnowledge the helpful comments made by Mr. Aaron Martin Cohen, the International Development Center of Japan in the preparation of this paper.

ences had been implemented based on the industrial conditions of each country.

Japan has adopted many technologies and developed many industries. Without this import of technology, Japanese economic achievement would have been much more meagre than it has actually been. Let us first review the historical perspective of the transfer of technology in Europe, and then consider the state of the transfer, and then Japanese experience in the process of transfer.

Transfer of Technology and Industrialization

During the 17th and 18th centuries, a nation's wealth and productive power was a key to its survival in the keen competition between countries. Each government made great effort to strengthen economic performance.

Britain was able to initiate the Industrial Revolution in its domestic environment, which gave full opportunity for an individual's creative activities to be used, and which had strong entrepreneurship and the decentralized free enterprise system. But in the countries on the Continent, the economic conditions had not yet sufficiently matured so as to generate an Industrial Revolution by themselves. There were still strong trends of aristocracy, mercantilist and guild controls of economy, in addition to the low per capita income. 1) But even in imitating Britain, the situation was favorable only in the countries where there were already a system of centralized economy. Thus every government made great efforts to transfer new technology from Britain.

The first step in introducing new technology was concentrated on the acquisition of machines and the services of qualified personnel in order to start production. In 1750, a British Manufacturer, John Holker was invited by the French government to establish a royal textile factory for which ample financial support was to be provided. The necessary machinery and skilled craftsmen were brought in from Britain.

Then the British machine was copied, and the copies were set up in other factories, while French craftsmen were trained by the British craftsmen. Through the activity of this first factory, which would be called a "transfer center of technology", technological knowledge, business acumen, and administrative skills were transferred to the French economy.

In case of Prussia, disadvantages of geographical distance and the difference of language made it difficult to obtain access to British technology by means of securing machines and skilled craftsmen. Thus the Prussian government sent specialists to Britain under a systematic plan to gain new technology. For instance, in 1819, a young Westphalian locksmith named Egells was sent to Britain to study recent developments in machine production, and he established a machine-building works and iron foundry in Berlin using a state subsidy.2) A rather sophisticated approach for the transfer of technology was thus adopted by many countries, that is, they sought to train and educate people and make the transfer of technology easy by means of the help provided by scientific and technological knowledge. In Prussia, the Industrial Institute was established in Berlin in 1816, and Peter Beuth, head of the Prussian Department for

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1) David S. Landes, "The Unbound Prometheus", Cambridge University Press, London 1969, pp.126-138.
2) W.O. Henderson, "Britain and Industrial Europe 1750-1870", Leicester University Press, London, 1965, p.147

Industry, was appointed as a director.[3] Many similar educational and training institutes were established in this period, and they invited foreign specialists to teach and train various fields of specialists.

The final stage was the adoption and modification of transferred technology and the application of it to other sectors of technology and industry. John Cockerill's experience in Belgium showed an unlimited expansion of technological linkage. He first established a woolen machinery factory and gradually added new industries--an ironworks, steamship building, steam engine manufacturing, railways--, and eventually, he monopolized most of Belgium industry.[4]

After the 1820s, when the technology became linked with more scientific knowledge and facilities, the problem of market size became important. To secure markets, many governments imposed import taxes and gave subsidies for the protection of their own manufacturers. The problem of insufficient size of domestic markets thus appeared in this period.

In the case of Japan, the Meiji Restoration which took place in 1868 was the period when great effort was devoted to adopt modern Western technologies and approaches in many fields of culture, society, and economy.[5]

The first step the Meiji Government took was to create a strong and centralized administrative structure in order to cope with the challenges of modernizing and to unify the nation so as to prevent any crisis which could endanger the new government and its efforts to both safeguard Japan and bring her into the community of nations. To secure qualified personnel to serve as government officials, a nation-wide selective system of the prominent people was introduced and it was linked to the national educational system.

The next step taken was to improve overall educational standards, and a compulsory education system was introduced throughout the country. In relation to the industrial infrastructure, the Government facilitated creation and extension of a communication and transportation network and social infrastructure such as by city planning and establishing city water supply systems to replace wells. In fields directly related to industrialization, the Government provided utilities (gas and electric power), and promoted industrial standardization. Many governmental testing and research laboratories were established. These activities were aiming at supplying scientific and technological assistance to traditional industries to enable them to adopt and diffuse modern technology.

One urgent necessity for the Government was to find out the way to adopt foreign technology in combination with the management required to use the technology and to diffuse it the two among domestic industries. To make efficient use of limited resources such as qualified personnel, capital and technology, the government had to create nuclei of production fully supported by the national efforts.

The first activities of the government-run enterprises were to send students and missions abroad and make surveys of the latest state of the art of foreign technology, in their search for the most appropriate technology. The next stage was to construct factory

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3) W.O. Henderson, "The State and the Industrial Revolution in Prussia 1740-1870", Liverpool University Press, Liverpool, 1958, pp. 16-23

4) Op.cit., W.O. Henderson, "Britain and Industrial Europe 1750-1870" pp.106-138

5) Hiromi Arisawa (ed), "One Hundred Year History of Japanese Industrial Development", Vol.1, Vol.2 Nihon Keizai Shimbun Sha, Tokyo, 1967

buildings and to equip with imported machines under the supervision of foreign engineers hired overseas. At first, the main operations in the production processes were performed by foreign skilled craftsmen. Then foreign operators were gradually replaced by domestically trained workers. When the production increased and some expansion of factories was carried out, enough experience had been obtained so that some of the machines could be domestically assembled, although the main parts were still imported. At the last stage, the Japanese became capable of producing whole machines and facilities by themselves. In this stage, domestic factor endowment was fully taken advantage of, to build the most suitable facilities.

Government-run enterprises were established in various fields of industry such as textile, cement, paper, iron and steel, and coal and metal ore mining. In these factories, modern Western technology was adopted and assimilated. At the same time foreign engineers were hired and brought to Japan and many skilled workers were trained on the job.

Once the management of the government-run enterprises was established and the adoption of transferred technology was assimilated, then the transfer of ownership from Government to private sector was carried out in order to secure efficient operation and smooth transfer of technology in the private sector.

In the middle of the Meiji era, the industrial foundation of light manufacturing was developed and in the last half of the Meiji era, heavy industry such as iron and steel, and machinery was established. The industrial infrastructure and many enterprises which were established during the Meiji era played a very important role in the transfer of technology as an institutional recipient of technology since then.

Industrial Policy and Transfer of Technology

The process of the transfer of technology is analogous to the transplantation of a living plant. In order to sustain transplanted technology, it is necessary to provide a receptive environment in the form of a sound industrial base including adequate supply of energy, raw materials, capital and skilled labor, and the existence of related industries.

If the available resources of a country are limited, the first preliminary step for a successful transfer of technology will be to select a certain area of industry where limitations are minimal or can be easily rectified and concentrate all the efforts to provide an adequate environment for that industry.

In the case of Japanese economic reconstruction during the postwar period, the "priority production system" was introduced in order to achieve a self-sustaining economy and a higher standard of living under the constraint of limited savings and foreign exchange. In this system, the importance of an industry was evaluated in terms of its influence on the entire economy and its relation to the total industrial structure, by using as analytic tools technological linkage as well as simplified input-output relations. The future prospects were discussed on the basis of the anticipated degree of dynamism of market expansion, outlook for technological progress, and economies of scale in production.

After the priority production system was introduced by the government in 1947, coal mining, iron and steel, electricity and fertilizer were identified as the industries of first priority.6) The fo-

6)Hiromi Arisawa, op.cit., Vol.2, pp.6-30

reign exchange which could be allocated for the system was used to import heavy oil and raw materials for the iron and steel industry. A large part of the coal then mined in Japan was used for iron and steel production, and the increased output of iron and steel production which resulted was primarily allocated to expand coal mining operations. Then, the increased coal production could be used for iron and steel production as well as for power generation and chemical fertilizer production.

Through this virtuous circle of expanding production among industries of high priority, other industries such as agriculture, machinery, and chemistry could be stimulated through technological and material linkages.

The transfer of technology was encouraged after the industrial infrastructure was strengthened and the production activities recovered. The stimulus to adopt new technology mainly came from the necessity to reduce costs. It was a national necessity to provide energy and basic industrial raw materials for the whole economy, and produce competitive products for export, since the Japanese economy had to import almost all necessary natural resources. Thus international trade always put pressure on the quality and cost of Japanese products, and both the government and private sector have been very eager to lower the cost of production and improve technology.

The administrative system for introducing foreign technology into Japan was established in 1950, and was intended to encourage investment and transfer of technology on a selective basis. Under this system, a Japanese company which intends to make a licensing contract to receive technological assistance from a foreign company, is required to obtain validation under the Foreign Investment Law or the Foreign Exchange Control Law. Then the governemnt guarantees remission of fees, royalties and other payments as agreed.

The regulation concerning technological assistance contracts was eased in 1961 when improvement of international balance of payments was realized. It was further liberalized in 1968 and 1972, and now most technological licensing agreements can be automatically approved.

However, at the initial stage of post-war reconstruction of the economy, imports of technology had to be put on a selective basis in order to make effective use of the limited foreign exchange available. Top priority was given to contracts which served to the improvement of the balance of payments, followed in order of priority by the anticipated contribution to development of essential industries, and the development of industries serving public purposes.

Assigning priority was carried out by the concerned ministry. Many engineers and specialists in a ministry were mobilized to make development programs for each industry and some cost-benefit studies of the effects of new technology were carried out. These studies usually considered the impact on other existing industries and on small-scale industries so as to avoid sudden disruption of existing equilibrium conditions between industries.

Necessary coordinated measures were arranged by the government including tax incentives, special depreciation, and financial supports for introducing new technology.

In line with the priority ordering of the government, each company made its own effort to select most suitable technology. Technological information was collected through industrial federations, academic circles, trading companies, and many overseas observation and fact-finding missions. Then contact would be made to a source of technology.

The price of technology was not uniform reflecting the characteristics of technology, terms and contents of the agreements, the technological level of the recipient company, and the bargaining conditions among competitive suppliers of technology. The content of a licensing agreement would be divided into patent rights, know-how, technological data and blueprints, trademark use, sales and management information, and technical training and consulting. Thus, if a company wanted to obtain all of this, the price could be very expensive, but if it purchases only patent rights and makes use of its own potentiality, trademark and so on, the price could be far lower.

The ratio of average royalty payments to sales was 4.6 percent in the period from 1949 to 1960, 4.1 percent in 1963, 3.5 percent in 1965, 4.2 percent in 1966 in the case of Japan.[7] But recently more than half of the imported technology requires payment of a royalty exceeding 5 percent, though it must also be noted that the nature of technology today differs from that purchased in the past.[8]

The cumulative number of instances of technology imports by Japan from 1950 to 1971 through licensing agreement of more than one year duration is about 10,000 items, and the annual royalty payments amounted to $488 million in 1971. The active industrial sectors in importing foreign technology coincides with those which are also export-oriented and have a high technology intensity.[9] That is to say, the proportion of the machinery sector is 26.0 percent, electric machinery 17.9 percent, and chemicals 17.0 percent.

Most of the technology was imported in order to improve the existing system of production and to modernize old processes. In the case of coal mining, new machinery had been introduced from the U.S.A. and West Germany in 1950 and thereabout, and during the expansion of coal production in the 1950s, the imported machinery was modified to fit the working conditions in Japanese coal mines. In the iron and steel industry, in 1952 an advisory committee to the government proposed "The First Modernization Plan of the Iron and Steel Industry", and the industry started the modernization program concentrating on the improvement of strip mills. The Japan Development Bank provided necessary financing for purchase of investment facilities. The modernization of the iron and steel industry was further aided by introducing a total production system including the choice of plant site, and factory layout.

The priority production system could stimulate other industries linked by technological and material input-output relations. In the case of machine industry which is central in the field of engineering technology, the adoption of modern technology was done as follows.

The first step of the domestic production usually started from the so-called dead-copy production. It is said that the successful domestic production could decrease the price of a machine by one-thirds of that of the import.[10] To do this, one set of the transfer of technology was essential. That is, the assembly stage of a completed machine, and then necessary parts production such as hydraulic system parts, tools, gears, and bearings, and finally the basic material production as special alloys, foundry products, steel, and ingots of various metals. For instance, the number of cases of technology imported up to 1971 in each stage of the industrial machinery production was 859 for the assembly stage, 229 for

7) "Annual Report of the Import of Foreign Technology, 1967", Science and Technology Agency, Tokyo 1967, p.45
8) "Annual Report of the Import of Foreign Technology, 1971", op. cit. pp.14-15.
9) Ibi. pp.25-27.
10) Hirokazu Nakaima, 'Development of Industrial Machinery' in "Steel Design No.117", Shin Nihon Seitetsu Co., Tokyo, 1973, p.33.

parts production, and 236 for the basic materials.[11]

It would be clearly understood that in order to adopt such number of technology, the recipient company had to be specialized and had enough experience in production. In this respect, the development of small scale industries which can supplement a big company in making specialized products will be of great value for the transfer of one set of technology.

Transfer of Technology and Establishing New Industry

In such fields as the petrochemical industry, synthetic fibers, and electronics, new industries were developed on the bases of the transferred technology.

In this case more careful examination of the effects of the technology was required than in the case of an existing industry. The first problem to be examined was the impact on other existing industries of which products might be replaced as a result of the transfer of new technology. Second was the formation of a new company, so organized as to make highest use of the new technology. Finally, there was a problem of stimulating effective competition in the domestic market.

The followings are the case study of the development of the petrochemical industry in Japan.

The Ministry of International Trade and Industry (MITI) approved the "Petrochemical Development Program" in 1955.[12] In the program, three objectives were pointed out; to provide a stable supply of the intermediate raw materials to synthetic fiber and plastics industries, to substitute increasing imports of petrochemical products with domestic products and thereby save foreign exchange, and to decrease the price of petrochemical products. Thus the structure of industry could be up-graded and the economy could become competitive.

MITI set the target that the petrochemical industry should meet the entire domestic demand projected for the future at prices no higher than those of equivalent imports. It was very important for the Japanese economy to purchase semi-finished materials at prices no higher than the world price since Japan has to earn foreign exchange by the exports of finished products made from the imported raw and semi-finished materials.

The determination of expected domestic demand was a base for the estimation of production cost and plant scale. The cost of production of course is closely related to the scale of a plant in many processing industries such as petroleum refining, petrochemical industry, and metal refining.[13]

The estimation of domestic demand was done by MITI which considered many factors such as the increase of imports, the growth of the economy, the development of user industries, and the level of per capita national income. Necessary basic statistics were linked with the overall development plan of the government. The period of the estimation was usually five to ten years. The supply prices for this estimate were usually assumed to the initial price, hence the

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11) Ibid. p.33
12) "Ten-Years History of the Petrochemical Industry," The Association of Petrochemical Industries in Japan, Tokyo, 1971, pp.68-69
13) L. Lau and S. Tamura "Economies of Scale, Technical Progress, and the Nonhomothetic Leontief Production Function: An Application to the Japanese Petrochemical Processing Industry", in the Journal of Political Economy, Vol.80, No.6, 1972, pp.1167-1187

increase of demand by the decreasing supply price was neglected. For this reason, the realized demand was always larger than the estimate reflecting the decreasing supply price.

The next step was the establishment of new companies which could adopt new technology. It was required by MITI that these companies be well equipped both with technological and managerial ability, to make the best use of the transferred technology.

Thus the new companies were established on the basis of either existing chemical companies or petroleum refiners, and this could certainly help the new companies to acquire raw materials, skilled workers, and access to markets.

The selection of technology was carefully done, by considering the proposal submitted by each company. It included a production and sales plan, the share of exports in total output, the degree of import substitution, the necessary foreign exchange for the purchase of the facilities, and the cost of production. Each production and sales plan covered the period of five years. For the import of technology, the data required were the contents of the technology, the royalty payments, terms of the contract, and export restrictions.

The government arranged all the necessary initial conditions for the development of petrochemical industry; the opening of new plant sites, stable supply of raw materials, financing by the Japan Development Bank, special depreciation, and so forth.

Another important role of the government was to keep the domestic market effectively competitive by controlling the entry of new companies. In the initial phase of the development of the petrochemical industry the number of central companies was limited to four so as to secure for each market shares greater than the minimum efficient scale of the plant. After the first group successfully commercialized its products, the government started to encourage the entry of the second group. The number of the central companies thus became nine altogether. Namely, the number of the operating central company was two in 1958, four in 1960, nine in 1964, and eleven in 1969. The share of the leading company in ethylene production decreased from 62.5 percent in 1958 to 22.4 in 1964, and to 14.7 in 1969.[14] Under the decreasing cost curve to the scale of production, the competition by the new entry worked effectively to decrease the price. The average price index of petrochemical products in Japan decreased significantly from 100 in 1956 to 88.8 in 1958, 80.8 in 1960, 50.2 in 1964, and to 37.0 in 1969.[15]

Japanese petrochemical industry relied on foreign companies for almost of its technology. However, the new companies which adopted the transferred technology usually inherited the technological and managerial experiences from the existing chemical companies. The accumulation of production experiences was also favorable to adoption of new technology.

The establishment of a synthetic rubber company in Japan was a unique case of direct investment by the government. It was announced in 1951 that a study group for the synthetic rubber industry was set up by MITI, and in 1957 a joint venture of rubber and petrochemical companies with 40 percent capital participation by the government was established under a special law, and that this company became entirely privately owned in 1969 with the termination of the special law after the company established the foundation and made profit since 1961.[16]

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14) "Ten-Years History of Petrochemical Industry" op.cit. p.198
15) Ibid. pp.538-539

This is a typical example of a traditional method of establishing new industries in Japan by the government initiative for the purpose of securing public benefits, sharing huge risks, and avoiding private monopoly.

Transfer of Technology and Pacific Trade and Development

In the world's long history of industrialization, the transfer of technology has played an important role in the establishment of new industry in many countries.

Such transfer of technology normally takes place along with the flow of technological know-how, blueprints, and capital goods such as machines and plants. Thus relations in international trade become more important once a country starts to industrialize.

The first stage of the transfer of technology usually takes place when a country imports machines and learns how to operate them. Such operation technology is built up in skilled workers and engineers.

The second stage is to acquire maintenance and repair technology. If a machine is simple and manually operated, then the repair and maintenance are not difficult as they may be accomplished with simple tools and simple replacement parts. But if the machine is complex and automatically controlled, then the repair and maintenance technology is correspondingly advanced and requires specialized tools and parts.

The third stage is to establish engineering technology. In this stage, great accumulation of productive facilities and skilled workers are necessary, and various kind of specified materials are needed. Engineering technology bears great importance, since the level of engineering technology can be easily reflected by the level of productive facilities to be made, and the quality of products produced by the facilities.

The final step is that of planning and design technology. It includes the research and development activities for new products, and the designing of actual products. It is at this stage that a country can develop its own technology which is most appropriate to the conditions of its factor endowment.

A self-sustained industrial activity requires one set of technology at each stage, namely the operation, the maintenance and repair, the engineering, and the planning and design technology.

Thus it is important in the long run that a country develop a set of efficient technology in many sectors of industry including a traditional and indigenous industry where such one set of technology has already established though it may not be at an advance level.

At the initial phase of industrialization, a country has to import many facilities and semi-finished materials for production. Then it needs much more capital goods and internmediate products when the country starts building engineering industries.

Druing these periods, the problems of financing and impact of foreign purchases on the balance of payments usually appear. If such problems can be solved by international cooperation, the development process will be greatly aided.

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16) Keichi Oshima, "Government Measures for Technological Development" prepared for the seminar on the Transfer of Technology of the OECD, Istanbul, Turkey, October 5-10, 1970, pp.13-14

There are great possibilities in the future of Pacific regional development, since as a whole there are well developed markets, countries of different stages of development, sources of natural resources, and engineering industries and new technology.

The future step will be to establish a workable program of development in the Pacific region based on the long-term prospect of the transfer of technology.

Comments on Okita-Tamura Paper - Brian Johns

The paper provides an interesting historical survey of the Japanese approach to the importation of foreign technology and know-how. It shows that the transfer of technology to Japan was an integral part of that country's industrial policy, which in the post-war period has resulted in the promotion of certain key industries under the "priority production system". A particularly useful feature of the paper is the emphasis placed upon the requirements for the efficient diffusion of technological knowledge within each industry. The transfer of foreign technology does not cease at the point when a licensing agreement is signed with a foreign corporation. As the Japanese have recognised, the subsequent diffusion of that technology is a matter of vital importance. Thus in the case of new industries and new technology steps were taken to ensure that new corporate organizations were formed to adopt the technology, that there were adequate supplies of labour with the requisite skills, and that other complementary factors were present.

However the unique feature of the Japanese approach to technology transfer has been the extent of government intervention. In general the government acting through MITI has severely restricted that flow of foreign direct investment into Japan. Joint ventures between Japanese and foreign corporations have been permitted but mainly in cases where there was no other way of acquiring the required foreign technology.

In short the Japanese Government has sought to split the foreign investment "package" in such a way as to secure foreign technology which could then be used in cooperation with the relatively abundant domestic supplies of managerial and administrative personnel and skilled labour. The paper makes no reference to the cost of acquiring foreign technology in the way that this has actually been done. It would be interesting to have more information on this point. However Dr. Sekiguchi reports Mr. Okita's recent view that Japan has been too slow in liberalising the inflow of foreign direct investment. This view could be taken to imply that the cost of acquiring technolgical know-how from abroad might have been lower than it actually has been if the multinational corporations had been allowed greater freedom to establish production facilities in Japan. It is certainly worth reminding ourselves that the multinationals are producing a continuing flow of new technology as they adapt to changing conditions in both their home and overseas markets.

A host country can sometimes benefit from the presence of MNC if this gives better access to new evolving techniques and to the more advanced techniques which only become appropriate at a later stage of the country's development.

How far is the Japanese experience on the transfer of technology applicable to the situation of the less-developed countries? There is no doubt that the Japanese had certain advantages in importing technology which are rarely found in the less-developed countries. In particular the supply of skilled and educated manpower and of managerial ability was more abundant than that typically found in the LDC's today. For that reason the Japanese policy on technology transfer should not be regarded too readily as an example to be followed by the less-developed countries. However as Mr. Okita has indicated, Japan is now emerging as an exporter of technological know-how to the

rest of the world. For reasons which I shall indicate this feature of Japanese experience may bring benefits to the LDC's.

It is often said that Japan has been "catching up" with the developed high-income nations in the possession of advanced technology and in the process of industrialization. In the present context it may be more helpful to think of Japan as passing through a stage of technology intermediate between that of the developed and the less-developed countries. Japan has been obliged to adapt the technology imported from the advanced countries to her own particular situation. Adaptation has meant taking account of local factor proportions, the size of the domestic market, local tastes and indigenous culture and the availability of local manpower and skills. This adaptation by the Japanese of the technology originating in the advanced countries means that the technology which Japan can now transfer is likely to be more appropriate to the conditions in some LDC's than the alternative technologies which they could acquire from the advanced countries.

In Helleiner's paper there is reference to the possibility that particular products which contain a mix of characteristics demanded by consumers in the developing countries may nevertheless cease to be produced because a new product has been developed which fits in better with the characteristics sought by consumers in the advanced countries. Following that line of approach but applying to processes rather than products, one can say that certain technologies which were employed in the advanced countries 50 years or more ago would be applicable to the present factor proportions in some LDC's, but in fact such technology has disappeared because it has ceased to be appropriate to the factor ratios in the advanced countries. However Japan may be a source of intermediate technology for the LDC's as labour-intensive methods of production once appropriate to factor proportions in Japan become less and less economical in that country due to the rising relative price of labour. As we have seen in recent years industries such as cotton textiles and electronics may tend to shift away from Japan to certain less developed countries because of changing factor price ratios. Associated with this shift there is usually a transfer of technology to the particular LDC's.

Thus there are some reasons to be optimistic about the transfer of technology to the developing countries. In the first place the entry of Japan as a seller in the world market for technology implies additional competition in that market. This extra element of competition can certainly do no harm to the buyers of foreign technology, including the LDC's. Secondly, the adaptation of imported technology by the Japanese means that it may have been modified in such a way that it is now more appropriate to the requirements of the developing countries.

One final matter. The paper points out that in Japan the Government arranges tax incentives, special depreciation allowances and other subsidies, to assist in the adoption of new technology by domestic firms. The less-developed countries ought to be warned of the danger of following a similar policy and subsidising the importation of foreign technology. This warning is not applicable when the buyers of the overseas technology have perfect knowledge about the alternative open them. For in that situation, and it is probably typical of the less developed countries, the subsidisation of technology transfer may not bring the expected benefits and may only serve to increase the rents of the multinational corporations.

PART II

THE INTERNATIONAL TRADE OF TECHNOLOGY

5

THE ROLE OF MULTINATIONAL CORPORATIONS IN THE LESS DEVELOPED COUNTRIES' TRADE IN TECHNOLOGY*

GERRY K. HELLEINER

I. Introduction

In the study of multinational enterprise, which has burgeoned during the past decade, there has been a steady shift in conventional modes of analysis and of perceptions away from the earlier focus upon international capital flows and the direct investment package, and away from the earlier presumption of competitive markets. Today, analysis tends to assume that the various components of the direct investment package are decomposable (capital, technology, management, marketing, etc.) and that the markets for some of the key components are highly imperfect. Most attention has recently been lavished upon the international market for technology, which proves to be the most complex and imperfect of them all. Knowledge, it seems, is not only not free but it is not even available on competitive markets. Moreover, it is itself decomposable into constituent elements each of which has its own market.

The major sellers in this market, because they are the prime proprietors of nonmilitary technology in the West, are private multinational corporations. (In this paper, the term "multinational corporations" includes small firms as well as large, provided that they operate in several countries). These firms are frequently also the buyers, and a considerable proportion of the international trade in technology is at the same time intrafirm - and "not arms - length" - trade. Because there exists a massive deficit in thechnology trade of the less developed world with the industrial countries (i.e., the flow of technology is pretty much one way), the terms at which it is traded has emerged as a major area of confrontation between poor nations and rich. With the increasing insistence upon and achievement of national ownership, in whole or in part, of major productive enterprises in the less developed world, payments on technology will constitute an increasing share of the earnings of multinational corporations operating there.

At the same time there is increasing international emphasis upon the role of science and technology in the development process and the need for greatly expanded research on the technological needs

*I am very grateful to Helen Hughes, Sanjaya Lall, Paul Streeten, Frances Stewart and the participants in the Sixth Pacific Conference on Trade and Development, Mexico City, July 1974, for comments on an earlier draft. I alone am responsible for remaining errors and interpretations.

of the Third World.[1] This stems not merely from the appreciation of the major contribution of technological change to the aggregate growth of every economy in which measurements of the various factor contributions have been attempted, but also, and increasingly, from the perception that new technologies, adapted or developed to suit the peculiar resource and factor endowments, market sizes, and consumption patterns and needs of poor countries, are required if development aspirations of the type now considered appropriate in the Third World are to be realised.

While there is general agreement that an indigenous and independent capacity for technological development must be erected in the less developed countries as quickly as possible, for many elements of required technology "one cannot disregard that for many years to come the research and development potential will be highly concentrated in the developed countries."[2] In keeping with the static theory of comparative advantage, industrial technology, particularly "high" technology, will continue to be exported by those countries with the relatively strongest skill base, experience, and research capacity for its production, in return for other goods and services in which less developed countries are, for the present, relatively more efficient. The creation of a factor endowment which permits significant indigenous industrial research and development requires a wide range of developmental policies together, no doubt, with some "infant industry" protection. Such policies are subject enough for a separate paper.

The bulk of the literature concerning the role of the multinational enterprise in the transfer of technology to the less developed countries has been addressed to two issues: 1) the "appropriateness" of the technology being transferred; 2) its availability and cost to the purchaser, both absolutely and relative to the available alternatives. Both of these issues must be addressed simultaneously, since achievement of progress with one, without any change in the other, may generate negligible or even harmful results for the less developed countries.[3]

For some elements of "high" technology, the issue of "appropriateness" does not really arise since there are no alternatives remotely approaching the available one in total productivity. On the other hand, it has long been recognized that a technology importing country's national product can be lowered in consequence of a new labour-saving technology, even if it is accompanied by capital imports.[4] (Particularly is this so where demonstration effects lead more indigenous firms also to adopt the new technology). The provision of special government incentives for the foreign technology supplier or investor can also generate further negative net effects for the recipient country. Not only, then, can the gains from the introduction of new technology be fully appropriated by its foreign owners but it is also quite possible for the foreigners' gains to be realised at the absolute expense of the recipient country. The increasing concern at the international level with national distributional and employment objectives, which may even be traded off against income targets, provides a further dimension to the analysis of the impact of foreign technology upon less developed countries.[5]

1. See UN, World Plan of Action, 1971.
2. UN, World Plan, p.48.
3. Streeten, 1972.
4. MacDougall, 1960; Cohen, 1972.
5. See, for instance, Vaitsos, 1973.

As far as the cost of production or consumption technology in international markets is concerned, the crucial problem will continue to derive from the fact that oligopolistically organized multinational firms are the principal owners and sellers of industrial technology, on markets in which many of the purchasers are extremely badly informed and thus possessed of a minimum of bargaining strength. This cost is extremely difficult to measure since one cannot easily isolate one aspect of a multinational firm's activities, where it simultaneously derives income from earnings on capital (equity or loan), royalties and licence fees, sales of inputs and purchases of outputs at favourable prices, management and marketing fees, etc. It is difficult to establish even conceptually wherein its true earning strength (and market power) actually lies. This "fungibility" of its market power renders it difficult, if not impossible, to analyse technology markets by themselves in those instances in which international trade does not take place at arms-length. Moreover, when technology contracts include clauses granting the supplier considerable continuing control over the buyer's production and marketing decisions, or otherwise restricting his business practices, as they frequently do, it is still more difficult to establish the total "price" of the technology transferred.

A disproportionate share of the literature on technology "transfer" to less developed countries has been devoted to production technology in the manufacturing sector. While the development and dissemination of appropriate agricultural and other non-industrial technologies are no less important than those of industrial technologies, the role of the multinational corporations therein is not as central. Their comparative disadvantage in agriculture stems from the greater uniqueness of local ecologies, the consequent need for more locally specialised expertise, the relatively free international exchange of information, inputs, and research results, the comparative efficiency and widespread practice of smallholder agriculture, and the heavy research investments undertaken by government - all of which are interrelated.[6] Since this paper is concerned with the role of the multinational corporations, technology transfer in the non-industrial sectors will not be considered further here.

The paper is divided into four principal sections. The succeeding section summarizes the general character of the international market in technology and the role of the multinational corporations in it. The next two consider the corporations' role in the international transfer of production and consumption technology respectively. The last offers some views on technology policies with respect to the multinational corporations and reflections on the likely development of more appropriate technologies for the less developed countries.

II. The Nature of International Technology Markets and Multinational Firm's Participation Therein

6. The classic work on international diffusion of agricultural technology is Ruttan and Hayami, 1971. Multinational corporations' role in the suppression and/or spread of agricultural technology in the banana industry is discussed, together with more general analysis of technology in sugar and coffee, in Evenson, Houck, and Ruttan, 1970. If incentives become sufficiently great, some multinational firms may seek to commercialise aspects of agricultural technology which have not hitherto been considered propietary. Freeman, 1973 p.30.

It has become usual to refer to the principal contribution of the multinational firm to a host country, and the principal source of its market power, as its technology. In the words of one recent authoritative study, "Technology has been the trump card for most U.S. investors as they went overseas."[7]

The Components of the Market

Is it possible clearly to identify the "products" which are being traded in technology markets? Many have tried their hand at comprehensive definitions.[8] For the present purposes, it is sufficient to consider the following components of technology transfers:

1) technology, in the legally recognized form of patents or trademarks;
2) technology in the form of unpatentable or unpatented knowhow;
3) technology embodied in skilled labour;
4) technology embodied in physical goods.

The principal emphasis here, as in most other such analyses, will rest upon the "disembodied" technology, the first two components on the above list.

International technology transfers frequently take place without their being placed upon arms-length markets at all, as when multinational firms make certain information ("trade secrets," etc.) available only to their subsidiaries; such sales may or may not involve the recording of a price for the technology on the corporate books. Such international transfers are nevertheless just as much part of the international technology market as intrafirm goods trade which crosses international boundaries is part of the international commodity market. In other instances, technology payments may be recorded in circumstances where it is difficult to uncover any specific good or service provided to the purchaser which might have generated them; and which, presumably, must therefore be serving some other function.

What are the roles of patents and trademarks in international technology markets, and how do they relate to unpatented knowhow? While there has recently been a lively discussion of the benefits and costs to the less developed countries of adherence to the international patent conventions,[9] the consensus emerging seems to be that unpatentable knowhow with respect to the process of production is of greater significance than patented knowhow anyway. Technology payments in licensing and collaboration agreements in which patent rights are not involved typically exceed those in agreements in which they are. Knowledge embodied in the patent is, in any case, normally insufficient, by itself, to permit its efficient working.

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7. Stopford and Wells, 1972, p.177.
8. Perhaps the best-known and comprehensive attempt is that contained in UNCTAD, Guidelines, 1972. See also Vernon, 1970.
9. United Nations, 1964; Cooper, 1973; Vaitsos, 1972; Serconvich, 1973; Grundmann, 1970; Katz, 1973. UNCTAD, 1974.

"In contemporary conditions, public tolerance and legal protection of commerical secrecy has become more important than the patent system."[10] The legal status of non-patented business knowhow (trade secrets) is not totally clear, but the importance of legal stipulations can, in any case, be overdone, in the analysis of market phenomena. While the U.S. courts, for example, have ruled that they cannot enforce the payment of royalties for unpatented technology,[11] this ruling does not affect in any way the capacity of owners of unpatented knowhow to continue to collect for its use where they are its sole possessors.[12]

What, then, is the purpose of the patent system? The ostensible function of patents is to stimulate invention, innovation or both by artifically restricting imitation and competition and thereby creating quasi-rent for the innovator. The overwhelming majority of patents in less developed countries, however, are registered by foreign corporations. Patent protection there is thus of miniscule importance for the very small number of indigenous innovators and, since these countries do not develop, let alone export, technologies likely to be patentable abroad they do not receive reciprocal benefits from adherence to the Paris (patent) convention in foreign countries. Yet these patent rights are also of insignificant importance to invention and innovation in industrial countries since the much larger markets there can be expected to dominate their corporate decisionmaking. To make matters worse, few of the patents registered by multinational corporations in less developed countries are actually utilised in production there; and much of the "knowledge" they protect is, in fact, "mature" and freely available. The patents can therefore be presumed to restrict technology transfer rather than facilitate it; the patentees' main concern is likely to be the protection of export markets from potential competitors, or the facilitation of international flows of earnings. It follows that, while there may be minor benefits in the form of protection for indigenous innovators, "the presumption is strong that the less-developed countries gain little or nothing, and may even lose, from granting patents on inventions developed, published, and primarily worked abroad."[13]

Another important legal instrument for the maintenance and exploitation of market power is the trade mark. Its ostensible function is to provide a guarantee of quality standard. Trade-marks, unlike patents, are unlimited in their duration. Objectively speaking, they ought not to carry much worth to the purchaser, upon their acquisition in a country where they have not been employed before. Except for that small part of the market which may have encountered the mark abroad or in foreign publications, or in those countries where tourist demands may be a significant input into the pattern of "local" demand,[14] it carries no meaning to local purchasers and therefore little value to potential owners. Any goodwill accruing to the trademark in a country in which it is new will be the product of the performance of the trademarked product in that particular market, and therefore should be the property of the local developer of that market who has thereby earned it. Whether it eventually

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10. Johnson, 1970, p.37.
11. Joelson, 1973.
12. If these courts' jurisdictions could be extended beyond their borders, it might provide some incentives for rapid acquisition of such knowhow and restriction of such possibilities by the seller.
13. Penrose, 1973, p. 783.
14. Stopford and Wells, 1972, p.177.

carries local value or not will depend upon its local success. Yet under present conventions not only are payments made for the use of the mark from the first day of its use but goodwill is also considered to belong to the owner, not the user, of the mark; when the user's licence expires, he must either renew it - at a price - or acquire a new mark.[15] As a U.S. Senate study has sourly commented, "the food processors seemed to be profiting rather handsomely from teaching affiliated or non-affiliated foreigners how to accomplish the technological marvels of putting soup in a can, spicy rice in a box, or vegetables in frozen packages."[16]

The price for technology embodied in skilled labour or human capital presumably reflects, to some extent, supply and demand in that particular labour market. In this instance, however, human capital which is "on the market" independently of well-known multinational firms with reputations to protect may be of questionable quality. The effective part of even this portion of the technology market is therefore dominated by the same firms as sell knowhow in more disembodied form. Needless to say, so is the market for technology embodied in inputs and equipment.

As soon as it is granted that some technology is embodied in human capital, and that it can therefore be transferred internationally through the movement of engineers, scientists and managers, it follows that the "brain drain" can also be viewed as part of the international technology transfer question. While it is quite customary to consider the role of the multinational firms in transferring technology through human capital from rich countries to poor, it has been less usual, though no less logical, to analyse their role in transferring it in the reverse direction. Their employment of indigenous talent for the pursuit of their own particular interests may deflect it from more socially profitable research and development activity, even if it does not physically leave the country. On the other hand, "knowledge which has the capacity of generating more knowledge in a single head is.... exclusive and becomes property to the individual possessing it." To the extent that training by the multinational firms generates such "property" in supplier or otherwise related firms or in employees who subsequently leave their employ, there can be corresponding technological transfers in the desired direction. As Baranson has phrased it: "more important than the imparting of technical knowledge and manufacturing capabilities is the ability and willingness to implant indigenous engineering and design capability for continued technological transformation".

The Nature of the Market

Vaitsos has cogently analysed the peculiarities of the international market in technology.[17] Technology is a good, the use of which involves the owner in no marginal cost (except to the extent that some adaption to new surroundings might be necessary); it is non-exhaustible since it is not used up through use. It is also usual for the possessor of any particular type of technology to hold a monopoly on the right to its use. This may take the legal form of a patent or trademark, or it may simply consist of knowledge

15. UNCTAD, Restrictive Business Practices (Tookey), 1972, pp. 22-23.
16. U.S. Senate, 1973, p.602.
17. Vaitsos, 1970 and the summary of the most important points in Vaitsos, October 1970.

which is unique to the process or product in question but which is secret. On the other hand, its value to a purchaser - as represented, say, by the cost of developing it for himself de novo - may be great indeed. At the same time, the information available to many potential purchasers in this market, contrary to the usual assumptions of orthodox market theory, is very imperfect. "The item itself that one needs to purchase is at the same time the information that is needed in order to make a rational decision to buy it. What is needed is knowledge about knowledge". The problem rests with the very high costs of search.

There are two schools of thought on the consequences of this monopolistic and imperfectly informed market for the cost of technology imports to the less developed countries. Harry Johnson argues that since a discriminating monopolist will extract the highest possible price from each individual buyer, and since the demand from a low-income buyer will be more elastic than that of a high-income buyer, poor nations will acquire their technology imports at lower prices, albeit "monopolistic" ones, than must be paid by others.[18] On the other hand, those who emphasize power in the bilateral bargaining process between buyer and seller conclude that the bargain will be struck to the greatest disadvantage of the purchaser when his power relative to the seller is least. Extra-market activities and uneven-ness in strength between the two parties to a bilaterally monopolistic bargain are likely to generate an outcome unfavourable to the weakest bargainers, in this case the poorest countries.[19] Sufficient evidence is not available to settle this issue as yet; nor does it matter greatly. In either case, it is clear that greater information for the low-income purchasers and greater competition among the sellers will be likely to produce more satisfactory terms of trade for the less developed countries. (In some sectors, such as steel, there is already vigorous competition since the relevant knowledge is fairly standardized and "mature".)

Multinational Firms and the Market

It is frequently difficult, as has been seen, to assess the full costs attributable to technology imports themselves when there is a package of other inputs - capital, management, a variety of capital-goods and intermediate-goods - being supplied from the same source as the technology, and when there are other dimensions than price to the transactions. Wherever the multinational enterprise controls both the purchase and sale of goods and services crossing international boundaries, their prices will be established so as best to serve the firm's own objectives. These are most generally considered to be tax minimisation but they may also include liquidity requirements in particular national jurisdictions, risk minimisation, or the making of a better case for governmental protection or assistance.

The multinational enterprise may supply technology to less developed countries in a variety of ways. In addition to the over-discussed form of direct investment in a wholly-owned subsidiary, it may enter into a joint venture, licence, sell inputs of equipment,

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18. Johnson, 1970, p.41.
19. See the discussion of such influences in Walker, 1971. In the context of technology markets, Vaitsos takes essentially this position.

negotiate a management or marketing contract, erect plant on a turnkey basis, provide training, or various combinations of all of these. The circumstances in which particular firms will supply technology through one such means or another, and their decision processes in this regard, have already been the object of considerable study.[20] Rapid change in this sphere makes continued monitoring desirable.

Their preferences will depend upon elements of tax structure (tariff structure, profits taxes, taxes on royalties and other international transactions), legal provisions and restrictions of various kinds (relating to capital repatriation, foreign exchange controls, arbitration procedures, etc.), and the factors which enter into the economics of location (factor costs, transport costs, etc). The institutional form which multinational firms prefer for their exploitation of technological advantage seems to be related to their size, the nature of the technology, country of origin, and other such factors. In particular, simple technologies requiring a minimum of local adaptation and relatively "mature" in their development are more likely to be made available through licensing agreements than newer and more complex technologies, for which multinational firms prefer to retain wholly-owned subsidiaries. Larger firms and firms selling in conditions of differntiated oligopoly also tend to a preference for direct investment rather than licensing agreements.[21]

The benefits and costs of various institutional forms from the perspective of the technology purchaser have not been as carefully analysed as yet, and there is a dearth of empirical research upon relationships between host country or purchaser characteristics and the extent and nature of "unpackaging" of the direct investment package. There does exist some evidence, however, on the pricing of technology in joint ventures as against wholly-owned subsidiaries. Stopford and Wells succinctly summarize the issues. "Royalty payments have served as another way (in addition to capitalization of knowhow) for the multinational enterprise to capture some of the monopoly rents from a technological lead. In subsidiaries in which the enterprise holds all the equity, royalty payments are not needed to provide a return on technology. All the profits accrue to the multinational enterprise in any case - though even in this case royalties may play a role in reducing taxes or in moving profits through foreign exchange controls. However, in a joint venture, royalties play the additional role of distributing to one of the partners a share of the profits over and above the profits associated with his share of the equity. There is some evidence that joint ventures pay larger royalties and fees for knowledge and management than do wholly owned subsidiaries".[22]

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20. See the series of studies commissioned by UNITAR, e.g. Baranson, 1971, Ozawa, 1971 and especially that by Chudson 1971; Stopford and Wells, 1972; Gabriel, 1967; Chudson and Wells, 1974.
21. For discussion of these issues and results, see UNCTAD, Guidelines, 1972; Chudson, 1971; Stopford and Wells, 1972; Baranson, 1970; Chudson and Wells, 1974. Vernon, 1971; Balasubramanyan, 1973; Cooper, 1973; Caves, 1971.
22. Stopford and Wells, 1972, pp.121-122. See also Lall, 1971, 1971, pp.93-5, 119-120.

While the multinational enterprise will seek to hold down the level of profits in countries where they are participating in joint ventures so as not to share their earnings with local equity owners, these local owners can also force the firm to be more circumspect in its dealings with the parent firm. How this balance is eventually struck will vary with the circumstances. There is some evidence to suggest that whereas transfer prices for the provision of know-how, trade names, and management services from parent firms were higher for joint ventures than for wholly-owned subsidiaries, (indeed these charges are frequently non-existent in wholly owned subsidiaries) those for goods purchases were generally lower.[23]

In what parts of the industrial technology market does the multinational corporation typically sell? By and large, it is usual to find the accusation in the literature that the multinational firm only sells industrial technology which it had already developed for use in its own main markets, and which is therefore frequently inappropriate to the needs and demands of the less developed countries.

III. The Transfer of Production Technology by the Multinational Firm

The theory of the product cycle is the best known general account of the factors affecting the transfer of production technology in the manufacturing sector to less developed countries by multinational firms.[24] This theory is based upon the fact that firms with technological leads acquired through the development of new products possess quasi-monopolistic positions in the production and sale of these products and the hypothesis that they will exploit them in a varying but predictable manner as the product matures. The less developed countries, according to the theory, acquire the relevant technologies only late in products' life, when production has become standardized, the monopolistic position has been eroded, price, rather than other forms of, competition exists, and current scientific and technical inputs are no longer required. At this point, the less developed countries' comparative advantage based on cheap unskilled and semi-skilled labour comes into play.

Unfortunately, this theory "breaks down rather badly"[25] as far as observed technology transfers to less developed countries are concerned since:

1) quasi-monopoly frequently endures far beyond the point of "maturity," as when it is based upon firm-specific experience and knowhow, brand names and trademarks, etc.;

2) international factor flows within the firms may enable and do produce transfers of location to less developed countries long before a product has "matured;" local factor endowments are not the sole determinant of the possibility of production there.

3) oligopolistic market structures and the creation of protective tariffs and quotas in the less developed countries may force multinational firms to locate production there for de-

23. Stopford and Wells, 1972 pp. 160-162.
24. Vernon, 1966; Hirsch, 1967; Wells, 1972.
25. Cooper, 1972, p.11. The first three of the points which follow are Cooper's.

fensive reasons well before the product is mature; moreover, these same protectionist measures enable the firms to earn from their original monopolistic advantage long after it has been eroded at the international level.

4) the theory is based upon final products, whereas there is increasing resort to the production of components and intermediate activities in the less developed countries within vertically integrated manufacturing industries some of which are also quite "immature."[26]

It would seem wisest now to abandon the theory of the product cycle as a general theory of technological transfer, retaining it only for those segments of the technology market to which it is still clearly applicable. In its place we shall have to erect an eclectic theoretical structure which allows for a variety of technological characteristics.

We might begin by considering what types of industrial production technology have, in fact, typically been transferred under the aegis of the multinational firm. There are many reasons for believing that multinational firms tend primarily to participate in that segment of the production technology market in which capital-intensive technologies and/or technologies requiring relatively large scale for efficient operation are employed, and that the technical change which they conduct research upon and create tends to be of an unskilled-labour saving kind. Among the most frequently cited arguments for such an unfortunate bias in their resulting technological transfers to less developed countries are the following.[27]

1) Non-existence and Non-development of Appropriate Technologies.

Efficient technologies for use where labour is cheap relative to capital, as it is today in less developed countries, simply do not exist. Nor are there incentives for their development by the multinational firms in their principal markets where the relative price of labour continues to rise. The small markets in the less developed countries, together with other factors mentioned below, do not offer sufficient incentives to the firms to justify the development of more appropriate technologies for exclusive use there.

2) Inadequate or Inappropriate Price Incentives.

(i) Multinational firms have access to relatively cheap capital. The factor prices upon which they base their decisions are not those of the particular less developed country in which they happen to be located; they are therefore selecting capital-intensive techniques on the basis of rational calculations in which factor prices do not reflect the social opportunity costs of capital in the host country.

(ii) Factor and other prices in the less developed countries are

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26. Helleiner, March 1973.
27. It would be tedious to cite references for the most familiar of these arguments. They will therefore only be provided where the argument may be less familiar and the reference less well known. Particularly useful sources are Mason, 1971; Strassman, 1968; Chudson and Wells, 1974.

themselves distorted so that they do not reflect local factor endowments or encourage labour-intensive activities or techniques: capital is underpriced in consequence of investment allowances, accelerated depreciation, overvalued currencies, subsidised credit, and the structure of the tariff; while labour is overpriced because of minimum wage and other social and labour legislation (some of which, however, may slow the rate at which capital can be substituted for labour once a new plant is in place).

(iii) Unskilled labour is frequently of very low productivity so that, while the wage rate may seem relatively low, it is not cheap in terms of efficiency wages. (This explanation is more applicable to some places and periods than to others. It is presumably becoming generally less plausible and is certainly at variance with recent evidence that Mexican and Southeast Asian labour learns new tasks faster than American labour).[28]

(iv) The heavy protection and monopolistic or oligopolistic position typically enjoyed by the multinational firm in the markets of less developed countries removes any pressure upon it to adopt the most efficient (labour-intensive) technologies.

3) Technological "fixity"

The decisions of multinational corporations are characterised by technological "fixity" in the sense of factor substitution in elasticity. In part, this reflects the fact that their advantage in foreign markets derives from their monopoly of knowledge over the specific techniques which they first developed in home markets and which are therefore likely to be inappropriate. In part, it results from the fact that multinational firms have tended to operate in industries (like minerals processing) in which technology is both capital-intensive and "fixed". In the manufacturing sector the products they sell, which were originally designed for richer populations, are typically standardised and subjected to strict quality control; these controls over standards imply relatively capital-intensive and inflexible techniques of production for these particular products although it might have been possible to meet consumer demand for the same basic characteristics through the provision of an alternative product with a more appropriate production technology and/or more flexible quality controls.[29] In part, this "fixity" may also be the consequence of the employment of engineering rather than economic criteria in their corprate decision-making, with a resulting tendency to prefer "modern" capital-intensive techniques irrespective of relative factor prices and possible alternatives.[30]

4) Scale and Complementary Inputs as Complications

(i) While efficient labour-intensive technologies do exist, in the present state of knowledge they tend to be associated

28. Ranis, 1973, p.403; Ranis, 1972, p.33.
29. Stewart, 1972, pp. 112-114.
30. Wells, 1972; Yeoman, 1968.

with small scales of production. (Medium and small scale firms are usually more efficient in the economic sense than are large firms, except in continuous process industries; scale economies in the industrial sector are not always as important as many have thought).[31] The multinational firm typically (but not always) produces on a large scale and it is that scale which determines the efficient factor-intensity; i.e., scale economies dominate factor price considerations, with the result that the technology chosen is capital-intensive.[32]

(ii) Shortages of skills, which are complementary inputs to unskilled labour, make it difficult to use labour-intensive technologies; capital is rationally substituted for labour in order to circumvent skill shorgate.[33]

(iii) In less developed countries material inputs often constitute a large proportion of total costs in the manufacturing sector. Where they are imported they may be particularly costly and difficult to acquire because of foreign exchange controls. In such circumstances there are incentives to substitute other factor inputs for such materials, and capital-material substitution elasticity (through storage facilities which reduce spoilage, mechanised materials handling which reduce breakage, and electronically controlled equipment which mixes ingredients to the exact specifications, etc.) is greater than labour-materials elasticity.[34]

5) The Role of Uncertainty.

(i) Multinational firms are risk-averters. They are reluctant to face the uncertainties and possible diruptions associated with labour relations in less developed countries, and consequently opt for capital-intensive techniques and small, stable work forces even if the average return is thereby lowered. Since payment of higher wages may actually lower the efficiency wage bill in less developed areas where lower turnover, better health, nutrition and morale are the consequence, this practice may generate both lower risk and higher return.

(ii) In some instances capital-intensive techniques may also provide insurance against unexpected fluctuations in demand more effectively than labour-intensive ones. It may be easier and cheaper to alter the number of shifts or the machine speed in an automated plant, in response to fluctuations in demand, than to hire and train, or lay off employees in a labour-intensive one. Variable costs are also typically lower in a capital-intensive plant than in a labour-intensive plant than in a labour-intensive one, making it easier for a firm to ride out future periods of low prices and/or increased competition when once the capital costs have been recouped.[35]

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31. Berry, 1972; Todd, 1971; Ranis, 1973; pp. 401-402.
32. Berry, 1972; Strassman, 1968; Silbertson, 1972; Yeoman, 1968; Pack, 1974.
33. Hughes, 1973, p.331; Mason, 1971, p.46.
34. Roemer, 1972, pp. 5-6; Pack, 1974.
35. Wells, 1972.

6) "Good Citizenship."

Governments or private purchasers of technology in the less developed countries often prefer to have "the latest" in terms of technological development (or "modernity") and resist the use of second-hand equipment even when it is economically more efficient and when the multinational firm is able and willing to supply it at a suitable price. (Sometimes problems with parts and servicing make these preferences quite rational). In such cases good corporate citizenship, which is not such a problem for indigenous businessmen, consists of bowing to these pressures for "prestige" technologies rather than efficient ones. Pressure to create jobs could, however, work in the reverse direction.

Non-existence of appropriate technologies and technological fixity are in increasing disrepute as explanations of the use of capital-intensive technology in the industrial sector in the less developed countries. A number of recent studies suggest that there may be rather more elasticity of factor substitution in the manufacturing sector than had been suspected. Empirical estimates in both rich nations and poor while resting on weak methodological and empirical foundations, indicate sectoral elasticities significantly different from zero;[36] cross-section data typically yield higher elasticities than do time series data suggesting that opportunities to alter technology in response to country-specific factor prices have frequently been seized. More detailed and micro-level studies confirm these aggregative findings. Not only has this substitution been found in ancillary activities (handling, preparation, packaging, and grading, finishing, manual transfers between production line segments, office administration, etc.)[37] but also in the production process itself - notably through adaptation of machinery, greater machine speeds, lower quality material inputs, the use of increased shifts, and subcontracting activities in selected production processes.[38] Some of this observed substitution also reflects alterations in product-mix, within the industrial classifications studied; such alterations also constitute a major means of planned factor substitution. Bruton's survey concludes "Factor substitutability is alive and well in developing countries."[39]

Moreover, while it may, superficially, be true that capital-intensity in foreign-owned (particularly American) firms in less developed countries exceeds that in local firms,[40] this finding frequently does not survive disaggregation. In particular industrial sectors, the multinational firm has often proven more responsive and adaptable in its factor and input use, especially in the ancillary activities associated with the basic production process, than local firms; and so it perhaps should with its wide range of experience upon which to draw. Vaitsos suggests a number of other reasons why foreign firms may employ more labour-intensive techniques than local

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36. A very useful compendium of research results on factor substitution has been prepared in Morawets, 1974; I have benefited greatly from it. For results and critiques see also Bruton, 1972; Winston, 1972; Stewart, 1973; Pack, 1974.
37. Mason, 1971; Pack, 1972; Strassmann, 1968; Doyle, 1965.
38. Ranis, 1973; Pack, 1972; Wells, 1972.
39. Bruton, 1972.
40. Hughes and Seng, 1969.

firms when both are producing the same products: their better managerial capacity and/or greater capacity to hire local skilled supervisory staff, their larger markets and therefore capacity to use extra shifts in minimum efficient scale plants, their greater need to demonstrate "good corporate citizenship."[41] Preliminary results of a detailed study of 1400 firms in Israel, Colombia, the Philippines and Malaysia indicate that in industries in which capital-labour substitution is evident, the multinational firms used their capital more intensively than local firms so as more than to offset their higher capital-in-place to labour ratios.[42]

On the other hand, the multinational firms' choice of product within broad import-substituting demand categories does tend frequently to be capital-intensive in production. It may therefore be helpful to consider this question at two levels - 1) that where the capital is still "putty" and there is freedom to select the products to be produced on the basis of their technological requirements and flexibility in use, and to choose the specific technique to be employed in the production of each product; 2) that where the capital is alrealy "clay" and the issues relate to its adaptation, speed and capacity in use - "capital-stretching" procedures.[43]

The fact that absolute technological rigidity has been shown not normally to be an issue except, perhaps, within a limited range of continuous process industries, does not alter the fact that attempts to add to the technology shelf on the labour-intensive end by multinational firms or by anyone else have so far been limited. What all this evidence suggests is that the provision of sufficient incentives might engender private sector responses in technological adaptation and development; factor prices do matter.

There also exists evidence to suggest that multinational enterprises are more likely to employ more labour-intensive techniques and use capital more intensively in their plants in less developed countries when they face more intense price competition[44] just as theory would lead one to expect would be the case for all firms. It follows that policies seeking to influence the choice of technique through influencing the structure of input prices will be less likely to work where price competition is weak. There is therefore a presumption that there will be stronger incentives to utilise efficient technologies in production for world markets than in production for protected home ones. Labour-intensive technologies are already being transferred in dramatic volumes for use in low-wage countries' manufacturing for export.

Multinational firms already play a very great role in the development of manufacturing for export in the less developed world, both within that world and for export to the industrial countries. In 1969, about 44% of intra-LAFTA trade in manufactured products was conducted by firms which were 90% foreign-owned or more; and another 14% was accounted for by joint ventures in which the foreign interest varied between 30% and 90%.[45] In 1971 foreign firms accounted for over 15% of South Korean manufactured exports, over 20% of those of Taiwan and over 50% of those of Singapore.[46]

Particularly where they have lost their complete control over

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41. Vaitsos, 1973, p.17. See also Mason, 1971; Pack, 1972; Strassman, 1968.
42. I am indebted to Helen Hughes for this information.
43. This formulation I owe to Winston, 1972.
44. Yeoman, 1968; Wells, 1972.
45. Casas, 1972, referred to in Diaz-Alejandro, 1973, p.22.
46. Cohen, 1973, pp. 3-4. These percentages would undoubtedly be higher if a broader definition of foreign firm "participation" were employed, e.g. in marketing, licensing, etc.

"older" technologies, the multinational firms have offered access to foreign markets, over which they can often retain control, as a substitute. Multinational firms may move increasingly into the "software", organisation and marketing, of international production leaving the problems of managing labour and raising capital to others.[47]

While there is an obvious presumption that manufacturing for export from the less developed countries will be relatively labour-intensive, there exists some scattered evidence that manufacturing for export can be quite capital-intensive, apparently because of the efficiency derived from large-scale operations which are themselves "inherently" capital-intensive, even when found in what are usually regarded as labour-intensive industries.[48] This capital-intensity may also be the product of excessive or inappropriate export incentives.

This association between capital-intensity, scale economies and export performance may have profound implications for the desirability of economic integration in the less developed world. While the rationalization of industry which may follow common market and/or complementation agreements may generate scale economies, the increased scale may be associated with greater capital-intensity; the efficiency gains may therefore be offset by employment losses. If, at the same time, the overall degree of protection against third countries remains unaltered and the rationalization is taking place within a foreign-owned sector, these efficiency gains may be wholly appropriated by the multinational enterprise (together, perhaps, with local "partners"); even the domestic tax obligations may be avoided through the appropriate manipulation of transfer prices, fees, etc., in such a way as to leave local reported profits unchanged. In such a case, the impact of the rationalization upon the host region is negative. All of this suggests that research attention be devoted to large-scale labour-intensive techniques in sectors in which there is technological fixity at present, and not be confined to the development of more efficient small-scale technologies.

On the whole, however, the participation of multinational firms - whether as sourcer/traders or as investor/technology suppliers - in the development of manufacturing for export from the less developed countries to the industrial countries has been primarily on the labour-intensive end of the technology spectrum. A wide variety of products are now being so exported and, provided that their markets are not cut off by restrictionist trade policies in the importing countries, their volume can be expected rapidly to expand.[49] The influence of the multinational manufacturing firms can be expected to be wielded in the formation of these policies in such a way as relatively to favour the free importation of those commodities in which they have a particular interest. Trade barriers are therefore likely to be erected primarily against the manufactured exports of less developed countries in those European and North American industries in which relatively weak domestic owners of capital ally with labour unions to demand protection and in which the multinational manufacturing firms are not involved; in these sectors, even if multina-

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47. Hymer, 1972, p.48; The Economist, as cited in Helleiner, March, 1973, p.34.
48. Diaz-Alejandro, 1973; Watanabe, 1974; Hufbauer, 1970, p.176; Gruber and Vernon, 1970, p.263 onwards. Gruber and Vernon also noted that some less developed countries were selling technology-intensive products to more developed countries.
49. Good discussion of the prospects can be found in Hughes, 1973.

tional trading firms are aligned against such barriers, and even if more liberal adjustment assistance policies were to be introduced, the combined pressures of labour and capital can be expected to prevail.

Thus the multinational firms are emerging as major suppliers of labour-intensive technologies in circumstances where they also exert major influence upon the likelihood that they can effectively be used (by exporting). Particularly dramatic are the possibilities for accelerating "the internationalization of production" under the auspices of the multinational firms by farming out unskilled-labour intensive processes and components within vertically integrated manufacturing enterprises to the less developed countries.[50]

It is high time for research and analysis of the international (and internal) distribution of the gains from the development of exports of manufactured goods from less developed countries and the influence upon them of transferring the required technologies in alternative institutional ways. For too long it has been assumed that diversification out of primary commodity exports into manufactured exports was, of its very essence, "a good thing." Now that it is occurring and shows every sign of continuing its recent trend, some doubts are beginning to surface.[51] As far as multinational firm activity is concerned, and the pricing of their services, manufacturing for export places the less developed countries at a particularly great bargaining disadvantage since they have neither scarce resources (as in the minerals sector) nor their own markets (as in the import-substituting sector) to withhold in the bargaining process. All they are able to offer is low-wage labour and there is no shortage of that particular input in the world arena. Hence the exemption of foreign investors who are manufacturing for export from the investment and technology codes of even those countries which have developed relatively advanced legislation for regulating the multinational firms (e.g., the Andean Pact and Mexico).

As long as the economy and polity are such as to leave large numbers of unemployed workers who would otherwise be contributing nothing to GNP and earning nothing, the multinational firm's provision of technology and/or capital, unless it has been induced to come by excessive subsidies, adds to the exporting countries' incomes (and employment) even if it does not alter any factor or product prices or contribute anything to tax revenues. If, however, the unemployment problem were to be resolved - as it appears to have been in some countries, particularly the socialist ones - the opportunity cost of labour would have to be considered in the assessment of the foreign contribution; if in these circumstances the multinational firm absorbed 100% of the return on the new technology itself, as posited above, there might no longer be any reason for the country to have it. The net benefit would depend upon the opportunity costs of the labour, capital and other inputs tied up in the activities in question; evidently, the gains from this type of technology transfer-where the bulk of the gains accrue to the multinational firm in consequence of the host countries' weak bargaining position - decline as the unemployment problem diminishes.

IV. The Transfer of Consumption Technology by the Multinational Firm

50. See Helleiner, March 1973, and references therein.
51. Cohen, 1973; Helleiner, July 1973; Streeten, 1973.

Until very recently, the international transfer of technology has been considered to be a matter exclusively of production technology. Foreign influences, among which that of the multinational firm is predominant, also profoundly influence the character of consumption in the less developed countries. ("Consumption" in this context should be broadly interpreted to include investment and developmental expenditures in both the public and private sectors). In many instances, the influence of the multinational firm upon consumption patterns is developmental or at least benign, as when it introduces new productive inputs for use in smallholder agriculture or new life-sustaining medicines; in these cases, the importing country may even welcome the firm's advertising and marketing efforts, although it must still be concerned with the products' costs and the possibilities for their reduction. In other cases, however, the multinational firm introduces and promotes the sale of totally "inappropriate" new products - products embodying characteristics which are superfluous or even undesirable, and unnecessarily costly, in the context of consumer requirements in the less developed countries.[52] Such unnecessary characteristics may be a matter of "brand names" and artificially stimulated differentiations in consumer demand, or of objective characteristics which "planners", subjectively, see as superfluous to social needs. (The latter is a far more controversial and philosophically difficult matter than the former). The transfer/sale of "consumption technology" to the less developed countries through the agency of the multinational firm deserves far more attention than it has so far received outside the courses in international marketing in North American business schools. It can best be analysed through the use of Lancaster's "new" theory of demand with its reliance upon the concept of product "characteristics."[53] Since this aspect of the multinational firms' activity in technological transfer is still relatively imperfectly understood, an appendix to this paper expounds on it a little.

The Theory of Consumption Technology

Frances Stewart, who has made most of the question of the inadequate "appropriateness" of products offered for sale by multinational firms, and her supporters, have been accused of an "arrogant and paternalistic" approach to consumers in less developed countries and of wishing "to ram down the throats of poor countries second rate products that they themselves would not look at."[54] Such accusations betray failure to grasp the essentials of consumption technology theory - a failure which, perhaps, deserves sympathy in view of the manner in which the presentation of the case has frequently confused production technology questions with those of consumption technology; these issues, while interrelated in practice, are conceptually separable.

In the Lancaster approach, each product possesses certain objective "characteristics." Thus most soaps for sale in the US market not only possess the basic ingredients which make them useful for washing but also are characterised by a variety of colours, smells, packages and brand names; other products can similarly be decomposed into their characteristics. The translation of these ultimate pre-

52. Stewart, 1972; Stewart, 1973. See also Haq, 1973.
53. Lancaster, 1966, April and May. See also, Green, 1971.
54. Streeten, 1973, p.5. The charge is not Streeten's own; he is summarizing others' debate.

ferences into market demands is constrained by the particular manner in which characteristics are congealed into products in the economy in question - that is by its technology of consumption. (At this point the technical reader may want to look at the appendix).

Poor consumers, because of their budget constraint, can be expected to demand products incorporating more "essential" characteristics and fewer "luxury" characteristics than rich consumers, although they may, of course, consume inefficiently.

Consumption technology changes through the appearance of new products (incorporating new pacakges of characteristics) and/or through the disappearance of old ones. Clearly, such changes benefit different people to a different degree, depending upon the nature of their preferences and the direction in which the consumption "frontier" is extended or withdrawn. In particular, it can be shown that technical change in consumption can be absolutely (as well as relatively) harmful to particular consumers. Thus the poor may lose from the disappearance of essential-intensive products which are replaced by more luxury-intensive ones.

The selection of a society's consumption technology is a fundamental policy question which is intimately related to the overall strategy of economic and social development and the political complexion of the state. The focus here on the multinational corporation's role should not be interpreted as reflecting the view that its role in these matters is always dominant.

The Role of the Multinational Firm

How are we to interpret the role of the multinational corporation in the development and diffusion of new consumption technologies? In the early years in which the trading companies first "opened up" parts of the less developed world to external trade the new consumption technology transferred may have been relatively "neutral" as far as such essential/luxury distinctions were concerned. In more recent times, however, it would be difficult not to accept the proposition that the consumption technological innovations introduced to the less developed countries by the multinational corporations have been biassed in the luxury direction. The bias in the introduction of new products is likely to have favoured the tastes of the wealthier classes, because their incomes were nearer the norm in the developed country markets for which the products sold by the multinational firms were originally developed.

To this discussion of characteristics must now be added the crucial element of "brand name," which usually serves to differentiate those consumer-goods marketed by multinational firms in less developed countries, purports to guarantee their standards, and which is the basis of their advertising efforts there. Control over consumption technology, through control over the use of the brand name or trademark, is a major source of market power for multinational firms in some industries. In such marketing-oriented sectors as food, beverages and tobacco, detergents, and ethical drugs, product differentiation and associated advertising and marketing skills are the principal source of the multinational firm's advantage over local competitors. In these cases, the firms concerned show a marked preference for wholly-owned subsidiaries rather than joint ventures or licensing arrangements so that they can maintain firm control over distribution channels (permitting price discrimination among countries without fear of commodity arbitrage) and the returns from the ownership of the relevant consumption technology. In some instances, where local governments have required the establishment of

joint ventures for the local manufacturing establishment, the multinational firms have maintained full ownership and control over the consumption technology by establishing wholly owned sales firms which handles their output or by at least retaining control over their exports.[55] This would seem to suggest that quality control and product standardization are not as crucial to the firm as ultimate control over the marketing of the "brand name." (Knowledge of local markets may, however, be an important advantage of indigenous firms or partners in some cases - particularly those in which multinational firms are diversifying their product lines and have not yet built up much marketing skill.[56] Joint ventures are therefore frequently found in such circumstances). In consumption technology, as in production technology, the, multinational firms not only earn monopolistically based returns but also sell inappropriate, or at least unnecessary, technology.

An area deserving of far more research than it has so far attracted is the advertising and marketing activity of the multinational firm, and its role in the development and diffusion of consumption technologies. Very large sums are spent in these activities and the multinational firms' proportion of the total messages conveyed through the media in many less developed countries is overwhelming. One of the few studies of this kind uncovered the facts that in Kenya, multinational firms sponsored over 80% of radio advertising in the Swahili language, over 75% of all newspaper advertising in Swahili and English, and owned the two major local advertising agencies which, by themselves, accounted for 45% of all advertising placed in the country and which constituted a major source of marketing influence and advice to locally-owned firms. Advertising played a particularly great role (over 6% of sales) in those multinational firms catering to brand-differentiated consumer demands - pharmaceuticals, soaps and detergents, toiletries, etc.[57]

The most favourable possible view of marketing research and advertising effort by multinational firms assumes that advertising and marketing are unlikely significantly to influence consumer preferences, particularly when considered in terms of characteristics rather than products.[58] The object of the firms' market research can then be seen as the unearthing of characteristic preferences in foreign cultures, the better to design products which efficiently cater to them; advertising then simply provides information as to the characteristics of the resulting "new" products. These new products can be expected to dominate older ones in at least some consumers' efficiency space, thus improving their welfare. While such new products may be socially beneficial and frequently are, the possibility of distribution effects such as were discussed above, removes any presumption that they should be.

Above average shares of total research and development expenditures by US multinational firms are conducted abroad in the soaps and cosmetics, and food products industries. These are industries

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55. Stopford and Wells, 1972, pp. 108-113. See also Lall, 1974.
56. Stopford and Wells, 1972, pp. 125-131.
57. I am very grateful for these data to Steven Langdon who has allowed me to use material which will be incorporated in his doctoral dissertation for the University of Sussex on multinational corporations in Kenya.
58. Green, 1971, p.160.

in which product differentiation might be expected to be based to some extent upon country-specific tastes and conditions and in which market research is required to uncover the relevant demand factors.[59] It seems safe to conclude that these abnormally high research expenditures abroad are for the purpose of such market investigations.

The sectors in which market research and advertising tend to cluster raise doubts as to whether marketing efforts by the multinational firms can always be viewed as benign. In the first place, even when underlying consumer preferences cannot be altered through advertising and persuasion, consumer spending patterns can be affected by the biassed flow of information which it produces. Certain products are vigorously illuminated, whether or not they are on consumers' efficiency frontiers, while the remainder are left in darkness. Secondly, and far more serious, market research, far from generating changes or adaptations in the product, may instead provide information on which to base changes in the advertising message so as to make the unchanged product appear to accord better with the locally preferred cahracteristics and culture. Advertising may provide misleading information.

There is also, of course, the very real possibility that advertising can, after all, affect tastes. As Boulding has pointed out, development is a learning process and preferences are learned just as are other elements of "knowledge."[60] How they are learned remains "mysterious indeed"[61] but only the very parochial (such as the "special case economist")[62] could retain for long the notion that preferences, even at the level of characteristics, are immutable. Multinational firms may therefore be playing their most important role of all in the conscious shaping of consumer tastes into a pattern which is receptive to the particular consumption technology which they are selling. (In some instances, such as their stimulation of the demand for "branded" milk-powder for babies, the effects have been reported as catastrophic).[63]

If these multinational corporate activities are affecting the technology of comsumption, and if that technology is seen as an object of governmental development policy, it may be necessary to abandon the present system in which, by implication, "all persuasive attempts are considered legitimate,"[64] and to institute certain controls over the use of foreign brand names and certain forms of advertising. If consumers require more security in their purchases, thought should be directed to cheaper ways of inspecting and controlling the quality of locally made products. Even a relatively passive host government should be able to cut back on excessive payments for imported consumption technology.

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59. U.S. Senate, 1973, p.584. Above average such shares were also found in the industrial and farm machinery industries where research on production technology suitable for local conditions was required.
60. Boulding, 1966, p.7.
61. Boulding, 1966, p.7.
62. I refer, of course, to Seers' classic paper on the limitations of the special case. Seers, 1963.
63. Artificial baby milk use has led to malnutrition and death in tropical Africa. Bottle-feeding has been promoted by vigorous advertising campaigns. New Internationalist, August 1973.
64. diTella, 1973, p.36.

Interrelationships Between Production and Consumption Technology

The interrelationships between "appropriate" consumption technology and "appropriate" production technology are rather more complex than is sometimes suggested. One must allow as many have not for 1) the possibility of tradeoffs between objectives in production technology and objectives in consumption technology, and 2) the role of international trade.

Frances Stewart draws out at some length the implications for choice of production technique of the development of alternative products for the satisfaction of given needs.[65] Choice of product undoubtedly greatly widens the potential for variation in production technology. She further posits that newer products (consumption technology), which are those most likely to be offered by multinational firms, are likely to be both more capital-intensive and more technologically fixed in their production. While some evidence supports this hypothesis, there is no reason for this always to be the case; more luxurious tastes can frequently only be catered to by highly labour-intensive means of production.[66]

Just as there is no presumption that capital goods industries will be capital-intensive[67] there is no presumption that "appropriate" products will employ "appropriate" (i.e., in this context, labour-intensive) technology. (Choice of product and, indeed of intermediate inputs, will also carry implications for foreign exchange earning or saving objectives, which are as important as employment objectives in some countries. Technological "appropriateness" can have other dimensions than labour-intensity).[68] In considering this question it is necessary also to allow for the indirect effects generated through linkages between the industry the final product of which is the object of final demand and other industries with possibly quite different technological characteristics. This complication further reduces the likelihood that simple generalisations in this sphere will be very helpful.

It is therefore not correct "to regard the inappropriate products argument as a particular development of the simple capital intensity argument, rather than an alternative."[69] The former is a matter of consumption technology whereas the latter is a matter of production technology. Although there might be a stable relationship between them, there are as yet no firm empirical grounds for establishing what exactly it might be.

A great deal of the discussion of appropriate consumption patterns also seems to employ closed-economy assumptions; there is, however, no necessity for production patterns to coincide with desired consumption patterns, as is often implied, where the opportunity for trade exists. This is particularly important for smaller countries where the role of external trade is likely to be greater. Even if the production of goods which were "appropriate" in terms of consumption technology were capital-intensive one could still acquire them through imports while selling labour-intensive goods, which might

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65. Stewart, 1972, pp. 109-114.
66. New luxury styles in footwear, for example, are more labour-intensive in their production than older, standardized shoe styles.
67. See Pack and Todaro, 1969.
68. A PhD. thesis at the University of Toronto by Roy Culpeper is uncovering a very wide range of foreign exchange-saving implications in alternative manufacturing processes in the Indian fertilizer industry.
69. Cooper 1972, p.13.

themselves be "inappropriate" for local consumption, for export. Only if autarkic objectives are also part of the overall strategy, or if export markets are constrained, does the argument for appropriate consumption technology necessarily have implications for production. In practice, as will be seen, it nevertheless indirectly often does.

As has been seen, the domestic production of new products promoted by multinational firms plainly may throw off many undesirable effects: 1) they may be more capital-intensive in production than the products they replace; 2) they may also generate frictional costs of redeployment even if, when the transition is complete, the factor-intensity in production is unchanged; 3) they may be "inappropriate" in the social sense, particularly if the products with which they compete are removed from the market or are available only at higher prices.

What if new "inappropriate" products are merely imported by the host country and not locally produced? Are there costs from inappropriate consumption technology which are dissociable from the above mentioned possible costs from the relevant proudcts' local production? Conceivably, such imports may cause unemployment in competing indigenous industries. Is there any other reason to oppose the introduction of such "inappropriate" new products through importation from world markets? As long as there are individuals with the incomes to buy them, it is usual to say, why should they not have the freedom to do so? Luxury consumption should be attacked at its root by altering the distribution of income which is its ultimate cause rather than by attempting to control what are mere symptoms. If the consumption of some articles seems particularly unnecessary and luxurious they can be heavily taxed (being careful to tax domestic production, should it arise, as well as imports so as not to create special incentives for the erection of import-substituting luxury plants). As long as these articles are obtained through importation there are no particular vested interests created in support of the maintenance of the markets for the products in question, and so for the distribution of income.

One might, of course, postulate that there is social harm from lavish consumption in the bad example it sets, the jealousy it engenders, or the decadence it shows. There do exist less controversial social efficiency arguments, however, for retaining a simpler consumption technology in the sense of less differentiation even of imported products. In particular, there will be gains, in the form of smoother and cheaper acquisition of parts and provision of servicing, from restriction of the range of imported products of any particular type below the full extent of internationally available differentiation. If one is to restrict imports in this way, it obviously makes sense to retain those which are most welcome and most likely eventually to be produced locally; these will be products which are on the essential-intensive and/or labour-intensive ends of the range of differentiation.

It is when domestic import-substituting production begins, however, that the need for controlling product differentiation really becomes of major significance. Where consumption technology has not been controlled and the full range of differentiated imports has been permitted, one must guard against the unnecessary and costly "setting" of the productive structure in the consumption technology's mould. Import substitution need not, indeed should not, mean complete replication of the import bill. Since many manufacturing industries benefit from scale economies, and since the size of the market in the typical less developed country is limited, the erection of a number of plants each producing competing differentiated product lines may involve considerable inefficiencies. Inefficien-

cies of this type are typically compensated for by tariff and other forms of protection. Thus the industrial sector in the less developed countries is frequently characterized by heavy protection, excess capacity and inefficiency in the production of a range of highly differentiated products. (Indeed this is the pattern in the Canadian manufacturing sector as well). The simpler is the original consumption technology, the less are pressures likely to be generated for the overdifferentiation of domestic production. This seems a more important issue in the interrelationships between consumption and production technologies in open economies than those relating to unproven generalisations about the likely factor-intensity of the production of appropriate products.

V. Technology Policies and the Development of Appropriate Technologies

Technology Policies

The "inappropriateness" of technologies offered to the less developed countries, which stems either from their factor-use characteristics (production) or the type of products (consumption) and which is by no means universal in the multinationals' trade, can presumably begin to be remedied once the less developed countries have themselves determined what they consider to be appropriate, and established mechanisms to ensure that that is what they actually demand and therefore acquire. The likelihood that governments in importing countries can and will formulate and control their national demands for foreign technology depends upon the character of the social and political system, the availability of information, administrative strength and bargaining power and the influence of the major technology suppliers themselves in the formation and management of economic policy. It may be, as Charles Cooper has pessimistically concluded, that a suitable technology policy "is in many fundamental ways in direct conflict with the interests of the political and eocnomic elites...(and)...must rest on the hope that the State, the high-income classes and foreign business...are either inherently progressive or else that they are sufficiently concerned about potential social tension to make timely concessions."[70] He clearly implies that such hopes are slim.

Yet technology contracts with multinational enterprises of whatever type can be and increasingly are being vetted by public authorities with the power to refuse permission on the basis of price, restrictive conditions, local availability of comparable knowledge, and economic value to the country. If foreign investments are, in any case, subject to government approval, as in most cases they are, this further step adds a further dimension to this screening process (while it adds to the number of cases which require approval). These procedures have recently been introduced in Mexico and the Andean Pact and seem likely to be introduced in more and more countries.[71] The criteria for assessing the suitability of the imported technology to local requirements are not yet as well developed as are those for assessing the terms of these contracts. In India, for example, in assessing the terms of foreign collaboration agreements, "No consideration is ordinarily given to...whether the parti-

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70. Cooper, 1973, pp. 300-301.
71. They are even expected by many in "liberal" Canada, and expectation which, I am told, has led to brisk business for patent lawyers and similar experts there in recent months.

cular technology sought to be imported is the most suitable to our requirements".[72] Clearly there would be a great deal to be gained through cooperation and exchange of information by the authorities entrusted with such screening responsibilities in the various countries of the less developed world, or in subregions thereof.

Greater control can at the same time be exercised over the degree of differentiation of locally produced goods. This objective can be achieved through industrial licensing which restricts the number of firms and the degree of differentiation in each product or industry. In some instances it may even be necessary to "turn back the clock," as did Chile and Peru in reducing the number of automobile firms already in operation. Where such licensing can be controlled jointly by cooperating governments within the framework of economic integration agreements, they will presumably be particularly useful.

It may be politically very difficult to license only a few firms for domestic production even where local markets are quite clearly too small for the full range of differentiated products all to be produced with reasonable efficiency. Consider this Indonesian complaint: "..a concession to one company often invites protest, sometimes even diplomatic moves, from the other parties.....for a country...dependent...upon the goodwill of a number of donor countries .....Even with a possible loss of efficiency, an open door policy is the only alternative. The result may be: a score of automobile assembly plants, fifteen pharmaceutical formulation plants, four condensed milk plants.....and so on.[73]

Moreover, the control of imported consumption technology may be a good deal more difficult and controversial than the vetting of imported production technology. It may be that simply seeking to extend the consumption technology is the most that can be achieved.

Can a relatively simple consumption technology be retained as development proceeds? As Lancaster has himself pointed out, the Soviet Union offers an example of an economy in which complex production technology coexists with relatively simple consumption technology coexists with relatively simple consumption technology.[74] Perhaps more to the point, can a relatively simple consumption technology offer social and economic advantages - in terms of social savings or improved distribution - without a concomitant alteration in the pattern of income distribution? It may be thought that if there existed effective demand for simple products they would already have been designed and marketed; that, in the absence of increased income for the potential purchasers new consumption technologies will be fruitless because there is insufficient effective demand for the purchase of alternative products which might incorporate them. It will no doubt immediately be recognized that whatever merits this argument possesses it relates only to that portion of consumption which is acquired upon markets and not to the public sector's share. The state can, by itself, exert considerable influence upon the aggregate composition of demand even in relatively market-oriented economies. As far as the market is concerned, whether effective demand exists cannot really be established before the relevant products are offered.

What can be firmly stated is that:

1) the offering of new products which offer more of the essen-

72. Frankena, 1974, p.258.
73. Sadli, 1972, p.223.
74. Lancaster, May 1966, p.15.

tial characteristics per dollar spent, and offer them in smaller units, is bound to increase the opportunities open to the poorer members of the world's population and thus to improve their welfare; this is quite regardless of whether the existing range of products available remains. Extension of the consumption technology rather than its transformation is sufficient to improve distributional welfare.

2) there exists a bias in the consumption technology offered by the multinational corporation which derives from the location of its principal markets and its low marginal cost for further exploitation of its existing stock of such technology; moreover, there is a bias in its research and the resulting change in consumption technology in the direction of more inessentials and product differentiation.

Thus policy in the less developed country should be directed toward the control or at least extension of consumption technology. Measures to extend consumption technology are obviously likely to be far more politically palatable than are more far-reaching measures to change the distribution of income, wealth and power.

No doubt one of the most difficult areas with which to grapple is the influence which multinational firms exert upon the policy decisions of governments in less developed host countries. They may seek directly or indirectly to influence the overall strategy of development and/or its detailed implementation through policies on taxes, tariffs, licencing and government expenditures. Evidence of such influence is not always easy to come by, but among the instruments for its exertion have been threats, missions, bribery, diplomatic pressure and subversion as well as more subtle and indirect ones. No discussion of the role of multinational corporations in technology transger to the less developed countries would be complete without reference to their potential influence upon technology policy formation there. Beyond this it is difficult to be very precise.

In any control scheme, whether of technology imports or of production itself, there exists potential for improper influence, corruption and abuse. There may also exist limited expertise and administrative capacity for the efficient running of such systems. Where, however, "the discipline of the marketplace" is in any case, not working properly because of heavy rates of protection, where "improper" influences may well already have been exerted on behalf of the present inefficient structure of production, where the social costs of the present structure have been demonstrated to be considerable, and where the necessary skills for government administration are increaslingly available, these traditional arguments against government import controls and industrial licencing schemes look less persuasive than they used to.

There does seem to be visible progress toward an alternative and controlled structure of demand for technology in the less developed world which may be no less significant for the pattern of future international (technology) trade than the conscious alteration of the pattern of imports of commodities was in a previous generation. Import substitution in the field of technology trade will not, however, take the form of mere replication of formerly imported technology. What is, above all, being sought is an alternative technology, which is, to a large extent, not yet in existence.

The Development of More Appropriate Technologies

What is the future role of multinational corporations in the

development and transfer of more appropriate production and consumption technologies. To write it off on the basis of the relatively limited such role which they have played in the past[75] is to adopt much too static a worldview and to close one's eyes to a number of recent developments, notably in the field of manufacturing for export, in which these firms are already very much involved.

Instead one must ask why the multinational firms have not been more engaged in the creation and transfer of more appropriate technologies in the past. Much of the explanaiton rests on fairly conventional analysis of incentive structures. Among the major factors operating, some of which have already been mentioned, were and are the following:[76]

1) private risks (particularly "political" ones) exceed the social risks,
2) unskilled-labour intensive technologies, particularly those suitable for smaller scales of operation and simple consumption technologies are likely to be relatively easy to imitate so that technological monopoly will not last as long,
3) incentive structures in the less developed countries themselves do not favour such technologies,
4) the firms have vested interests in (competing) technologies already available at very low marginal cost,
5) the total markets for such appropriate technologies in terms of effective demand are still small and growing at slower rates than the markets to which they are more accustomed to gearing their products.

Some of these factors may be influenced by policy makers in rich nations and poor through the provision of general incentives for innovation and the manipulation of the price structure so as to influence the direction of innovative effort.

Given sufficient incentives, there are good reasons for believing that multinational firms will become significant suppliers of more appropriate production technologies and products. (This is not meant to underplay the likely political resistance on the part of some firms to any attempt radically to restructure incentives or encourage competitive new techniques which may prejudice the returns they are already earning under the present dispensation). They are, after all, in by far the best short-run position to supply them. They have the managerial and organisational capacity, the capital, the research and development skills and the range of experience to respond to new market opportunities relatively quickly.

This is true both of adaptations in existing production processes and products and of the development of totally new ones. As far as the former are concerned, design alternations and adaptations are more costly smaller scales of operation; multinational firms will highly specialized and large-scale operations can rapidly and frequently alter product and component specifications in a way that is far more difficult, because more costly, for a relatively small firm in a less developed country once its capital has been "congealed" in its original plant.[77] The multinational firm can therefore both keep on the "technological frontier" and respond to new incentives with greater ease than can the firm in the less developed country.

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75. As for instance Mahbub Haq does, Haq, 1973, p. 135.
76. Many of these explanations are those offered by Streeten, 1973, p. 10.
77. Frankena, 1974, p.259.

Moreover, multinational firms are quite likely to control the use of such adaptive technologies in world-wide use, even when they have not themselves developed them. Contractual stipulations to the effect that local adaptations of licenced technology belong to the licensor rather than the licensee, while illegal in many developed countries, are frequent in technology agreements in less developed countries.[78] (Apart from their evident cost and inequity, such provisions constitute an important disincentive to technological initiatives on the part of licensees).

As far as wholly new products and processes are concerned the combined efforts of governments, international agencies, research institutes and private firms and individuals in the less developed world are unlikely to be able to match the multinational firms in effective research activity in the industrial sector for some decades; so much the more will this be the case if these efforts are often not politically supported in the less developed world.

The prospect of multinational corporate activity in the "new" and "appropriate" technology sector may be significantly affected by the technology policies of the governments of the less developed world, a point which seems to have been overlooked in previous discussions. In discussions of the benefits and costs of the patent system and adherence to the Paris covention in the less developed countries, for example, this possibility is ignored. It is usual to argue, with Harry Johnson, that "the contribution that the opportunity to earn a profit in their markets makes to the encouragement of investment in the creation of new commercial knowledge is negligible,"[79] and therefore that the less developed countries derive no gains from their continued adherence to the convention that monopoly rights to technology be recognized and paid for. But is this not too aggregative a view? Is it true for particular technologies of interest to the less developed world and the specialised firms which might cater to them? A distinction must surely be made between those technologies, the development of which would otherwise receive no encouragement, and those for which there are already adequate developmental incentives in the developed countries. The policy solution would seem to lie in the abrogation of payments by the less developed countries for the latter type and increased incentives, jointly offered by the countries of the Third World if possible, for the former.

Notice that if there are particular technologies sought, it is they that need particular support. The concerns expressed in many discussions of suitable technology policies and incentives have more to do with the choice between national innovators and foreign ones than with that between appropriate and inappropriate technologies. It is usually natively assumed that innovations by foreigners are likely to be inappropriate, whereas those by nationals will be appropriate.

In fact, foreign innovators can be a major source of research, development and innovation in the "new" technology sectors. In considering whether to offer patent and other protections for innovations in their own economies, the less developed countries must consider the implications for "desirable" R & D activities carried out under the auspices of foreign corporations. Markets for these technologies and products are to be found only in the less developed countries themselves; thus their decisions, as they affect the incentives for this kind of research activity, are critical to for-

78. Sercovich, 1973; UNCTAD, 1972.
79. Johnson, 1970, p.40.

eigners' behaviour. (Of course, it is possible for small less developed countries to benefit from the innovations which are the product of others' incentive systems. Like so many of these arguments, however, this one is subject to the fallacy of composition; if all the less developed countries with this option pursued it, it would no longer be one).

One would expect a variety of new and smaller firms to arise in response to these new market opportunities. While the bulk of research and development expenditure in developed countries has been found by Schmookler and others to be undertaken in large firms,[80] it does not follow that the research likely to be of greatest usefulness to less developed countries need be similarly concentrated there. Indeed there are some reasons for suspecting that smaller firms in the developed countries might be considerably more important in this range of the technology shelf than in that 98% of it which, according to the much-cited Sussex estimate, is geared to the needs of the developed countries. Small firms in such sectors as automobile parts and semiconductors are already earning considerable royalties from less developed countries on technology account.[81]

The types of research and development expenditure which are likely to generate more "appropriate" production and consumption technologies for use in low-income countries are notably not those in which scale economies and large inputs of capital are required. Rather, they are likely to depend upon skills and experience; they can therefore emanate from relatively small multinational firms specializing in this type of innovation. Smaller firms have been quite successful in generating new technologies in some sectors in the past. Large firms, after all, often tend to be overcautious, retain vested interests in older technologies, discourage creative endeavours through their team emphasis, and have ineffective communication and incentive systems; all of these factors can inhibit innovation and offset such scale economies as they may enjoy. Imitation in new industries - the development of superior variants of the product or process - can frequently be managed by even the smallest firms employing only "a few capable scientists and engineers,"[82] as in the case of the semiconductor industry.

From the less developed countries' viewpoint, the small size of a foreign technology owner is advantageous since it increases their relative bargaining strength and the likelihood that an agreement can be struck at favourable terms. Small firms, for instance, have been found more frequently to participate in joint ventures than large firms, no doubt because of their more limited resources. (Sercovich's ultimate defense of the patent system in the less developed countries rests on its peculiar advantages to smaller firms, which may have no other bases for market strength, as have large ones, and which can make better partners for the less developed countries).[83]

If there are sufficient incentives offered, there is no reason why the multinational firms, including some newer and smaller ones, should not begin to create and diffuse new and more appropriate production and consumption technology for use in the less developed countries. In the future, Baranson, for example sees these firms with "greater emphasis on the expansion of employment opportunities through production for world markets, more purposeful efforts to adapt production techniques in labor-surplus economies, and more intensive efforts to redesign industrial products for consumption by

80. Schmookler, 1966.
81. Sercovich, 1973; Chang, 1971.
82. Mueller and Tilton, 1969, p.575.
83. Sercovich, 1973.

low-income groups.[84]

The less developed countries are therefore faced with a dilemma. Should they offer incentives to foreign research and development activities of the type in which they are interested, or legally require local research expenditures, in the full knowledge that when successful, ownership of these technologies will rest with foreign corporations which will then control their pricing and use? If foreign corporations are truly the most likely to develop such new technologies quickly, the alternative must be to wait with their development until indigenous capacity (and political will) has developed to the point where the R & D can be undertaken by nationals. Perhaps indigenous capacity would expand more quickly if the multinational firms did not compete for the available skilled manpower and use it in their own more narrowly defined interest. The benefits of speed, probably lower risk and possibly even lower cost have to be weighed against the foregone domestic learning opoportunities and longer-term effects from having indigenous research capacity and locally owned technology. How the balance is struck will depend upon the particular circumstances of the country in question.

Whether more suitable technologies are developed for use in less developed countries by the less developed countries themselves will be heavily dependent upon government educational and other policies pursued there. In India, for example, it seems that domestic R & D has been discouraged by an inappropriate price structure and licensing system.[85] What little "indigenous design" there has been in the relatively advanced Indian machinery sector has primarily involved the replication of previsously imported items (some of them, admittedly, no longer obtainable abroad) or only the simplest of products.[86]

While there can be agreement that the development of local technical expertise through formal and informal educational efforts, some of them conducted or financed by the multinational firms themselves, is absolutely necessary if an independent inventive and innovative capacity or even the capacity effectively to absorb existing foreign technology is to be achieved, one must also recognize the dangers of offering inappropriate training and experience. The technological biasses found in the typical European or North American technical school, university or industrial establishment when transferred without adaptation to students, trainees and the very educational institutions of the less developed countries, can do far more lasting damage than the uncritical transfer of the technologies themselves. There can be little doubt that a good deal of the requisite technological learning will best take place through indigenous adaptations and experimentation.[87] As Vaitsos has noted, support for technological "learning" by indigenous firms is legitimately based on the infant industry argument; protection for multinational firms starting up in a less developed country is not.[88]

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84. Baranson, 1973, p.18. See also United States, National Academy of Sciences, 1973.
85. Frankena, 1974.
86. Frankena, 1974, p.256. Pack and Todaro suggest that the replication of vintage equipment no longer available on world markets may be an important function of an indigenous capital-goods industry. Pack and Todaro, 1969.
87. Ranis, 1972, p.34.
88. Vaitsos, 1973.

The Political Demand for Appropriate Technology

How likely is it that the governments of the less developed countries will adopt the kind of technology policies which seem to be necessary? The political economy of technology policy, to which Cooper addressed himself, suggests - although he did not himself make this point - that such policies are more likely with respect to some types of economic activity than others.

Powerful interests, not necessarily including the multinational firms, could be expected to oppose a shift in the orientation of domestic consumption technology towards essential product characteristics and away from luxury and internationally branded ones. (The much-cited example of the G.M. and Ford Asian cars do not alter this arguments; they involve fairly marginal alterations in the means of supplying the demand for transportation).[89] Extension of the range of available products in the essential-intensive direction is probably the most one can realistically hope for.

Such interests are also likely to look with some disfavour upon a restructuring of incentives which favours labour-intensive production for domestic markets at the expense of the established capital-intensive technology, or expanded state demand for more "appropriate" products or processes. Particularly might this be so if it seemed likely to generate a more inward-oriented (non-tradeable) output mix as some suggest it would.[90]

The creation of special such incentives for multinational and domestic investors proposing to engage in new manufacturing for export, however, creates no such opposition from any quarter. As far as production for export is concerned, the "appropriateness" of the product is economically and politically irrelevant. Since the ultimate buyer is a foreigner, it matters not how exorbitant or scandalously luxurious the taste to which one is catering. Production of wigs, meerschaum pipes or exotic perfumes are all undertaken for the purpose of earning income and foreign exchange, not for their inherent worth or appropriateness to local society. Such articles can be produced for export in an egalitarian socialist state or a thoroughly capitalistic one in which the distribution of wealth and income is highly skewed. Indeed a shift in the complexion or the political objectives of the government of a less developed country which already possesses a luxury-goods industry catering to domestic demand might simply lead to the redirection of its production into export markets. In the case of intermediate products or components, the "appropriateness" of which are difficult even to conceptualize, when they are produced exclusively for export, the technology of consumption is also irrelevant. While, as has been seen, there is something in Frances Stewart's declaration that "it is inappropriate for developing countries to consume those goods that developed countries produce,"[91] the further tenet that it is "inappropriate for developing countries to produce those goods that developed countries consume" is illogical and confining since it forecloses the possibility of developing exports of whatever kind from the poor countries

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89. The automobiles to be produced for the Asian market were still to be very highly priced. Far Eastern Economist, Sept. 30-Oct. 7, 1972.
90. Diaz-Alejandro, 1973. "The difference in labour use per unit of output between non-tradeable (home) goods and all tradeable goods is likely, in fact, to be greater than such difference between the import-substituting and export sectors", p.21. See also Haq, 1973.
91. Stewart, 1973; and reported in Streeten, 1973.

to the rich.[92]

In the light of these possible political influences upon governmental technology policies in the less developed countries, it is easier to forecast the development of more appropriate production technologies, and the continuing or expanded role of the multinational firm in their sale, in the manufactured export sector than in other parts of the Third World's industrial sector; and, riskiest of all to foresee change in consumption technology through the agency of the multinational corporations. All these things may nevertheless come to pass, particularly if sufficiently stimulated by the World Bank, developed country governments and others in both rich countries and poor who are "sufficiently concerend about social tension,"[93] and Baranson may yet prove correct. In the meantime, however, it would seem to make more sense to be sure we understand the full implications of labour-intensive technology transfers by multinational corporations for use in manufacturing for export from the less developed countries.

APPENDIX ON THE THEORY OF CONSUMPTION TECHNOLOGY

Let us consider a simple two-characteristic example: a consumer whose preferences are expressed in terms of only two characteristics - "washing quality" and "attractive packaging", and who can choose among four types of soap which incorporate these characteristics and are priced as follows:

	Soap A	Soap B	Soap C	Soap D
Washing quality per lb.	10 units	10 units	10 units	10 units
Packaging per lb.	3 units	2 units	1 unit	0 units
Price per lb.	20 cents	15 cents	15 cents	12 cents
Washing quality per cent	1/2 unit	2/3 unit	2/3 unit	5/6 unit
Packaging per cent	3/20 unit	2/15 unit	1/15 unit	0 unit

Following Lancaster, one can portray the available consumption technology by locating the available products in characteristics-space. The rays OA, OB, OC, OD in Figure 1 indicate the proportions in which the two characteristics can be obtained through the purchase of each of the goods A,B,C,D. The point A indicates that for a cent expended one can acquire 1/2 unit of washing quality and

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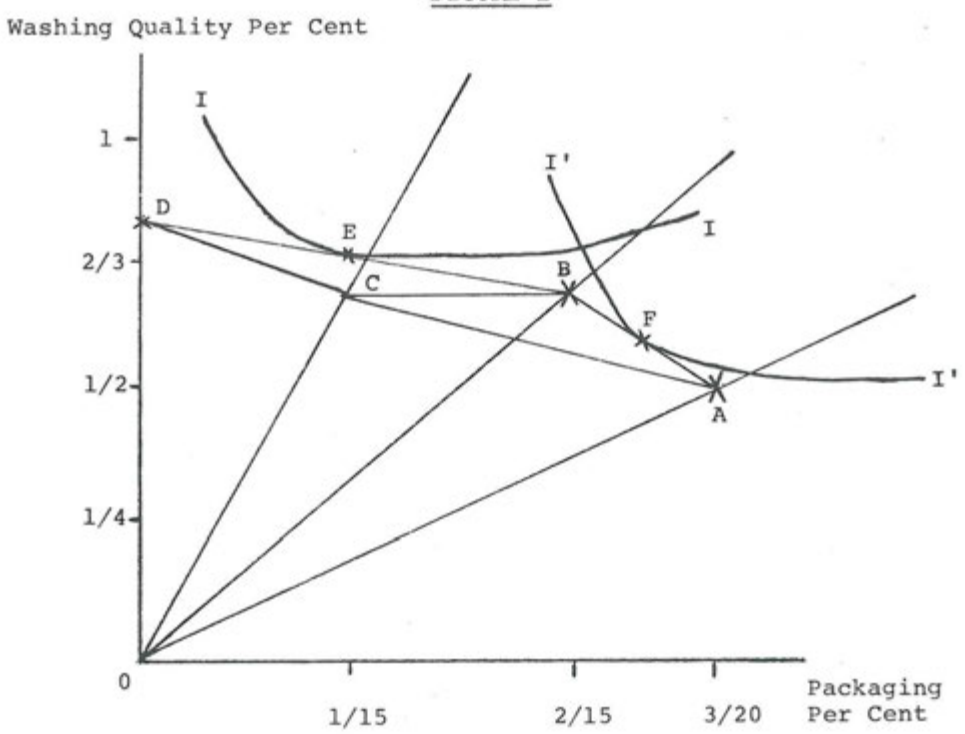
92. It might be argued that the production of luxury articles or components of articles which are themselves unknown and unseen may be peculiarly alienating in a low-income economy. Such alienation as may be found in such circumstances is more likely to be affected, however, by the circumstances of the workplace, in particular the factory situation, than in the characteristics of the product. The products of plantations, mines or even peasant agriculture, let alone those of such more modern industries as tourism, are not obviously any less alienating than those of the manufacturer for foreign markets.
93. Cooper, 1973, pp. 300-301.

3/20 of a unit of packaging. One can obtain any desired combination of the two characteristics by varying the proportions in which one purchases goods with the money to be spent. These possibility are depicted by the lines joining the various product points. Product B clearly dominates product C since one can acquire the same quantity of washing with a little more packaging (assuming that packaging carries positive value); the efficiency frontier is therefore giv-

FIGURE 1



en by the line ABD. Where the individual consumer settles will depend upon his characteristic preferences, which can be depicted, in terms of conventional micro-economic theory, by a characteristics indifference map. He will attain his highest possible indifference curve at E, the point of tangency between the consumption efficiency frontier and the indifference curve II. It should, however, be apparent that another consumer with a different set of characteristic preferences (and these preferences are bound to be related to his level of income), as shown by indifference curve II', might find he maximizes his welfare at a different point on the efficiency frontier, say F, which is clearly inferior to the point E when viewed from the first consumer's perspective; equally, for the second consumer point E is inferior to point F.

Consumers may consume inefficiently, i.e., inside the frontier, in consequence of imperfect information, managerial incapacity, and so forth but neither the market mechanism nor any other force imparts any particular discipline upon them (as in the case of production inefficiency) to improve their ways - except perhaps in the extreme case in which the lower level of welfare resulting produces starvation. Indeed very little information seems to be available

as to the efficiency with which consumers actually spend in the pursuit of their preferred characteristics. The literature of agricultural economics suggests that smallholders in poor countries are typically quite efficient producers, using inputs rationally in the pursuit of their objectives of high return and low risk; they are believed to do less well where the available technology is rapidly changing since there has not been time for the necessary experimentation to have generated results. As far as consumption is concerned, casual empiricism suggests that efficiency may not be so high; in any case, it is safe to assume that rapid changes in consumption technology will generate inefficiencies in consumption to the same extent that those in production do so in that sphere.

Technical change in the sphere of consumption consists of the appearance of new products and/or the disappearance of old ones, and the consequent shifting in the consumption efficiency frontier. Where preferences differ, the desirability of any particular change in consumption technology will vary with individuals. Consider the two consumers, whose tastes are represented by the indifference curves II and II', which both stand for a whole (homothetic with respect to the origin) map of such curves. The first consumer values washing quality relative to attractive packaging to a greater extent than the second consumer. Extending the frontier "northward" will clearly be of greater value to the first consumer; extending it "eastward" will be of greater value to the second. As long as the original collection of goods available is still intact (at the same price as before), the appearance of new products which dominate those on the present frontier will improve overall welfare according to the Pareto criterion. Where, however, the appearance of new products is accompanied by the disappearance of old or by increases in their price, this statement can no longer be made. (Lancaster, May 1966, p.22) (Pareto-welfare criteria are, in any case, not so useful in societies where the equity of income shares are of prime concern. The conventional wisdom in the less developed countries, and perhaps in many developed countries as well, seems by now to have led us (certainly it has led Mr. McNamara!) to the point where Pereto criteria must be rejected as a guide to social welfare gains).

Let us now alter the characteristics in our example, to make the relevance of this discussion of consumption technology still more apparent. Let us portray "essentials" on one axis and "luxury ele-

FIGURE 2

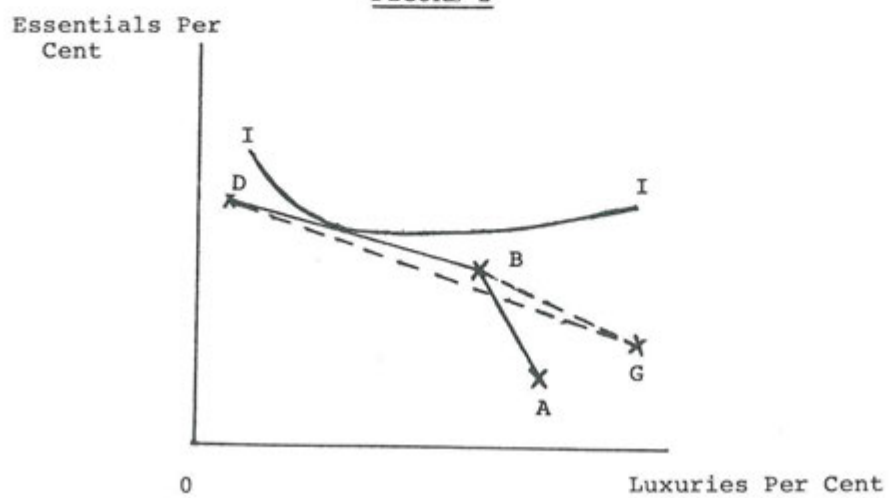
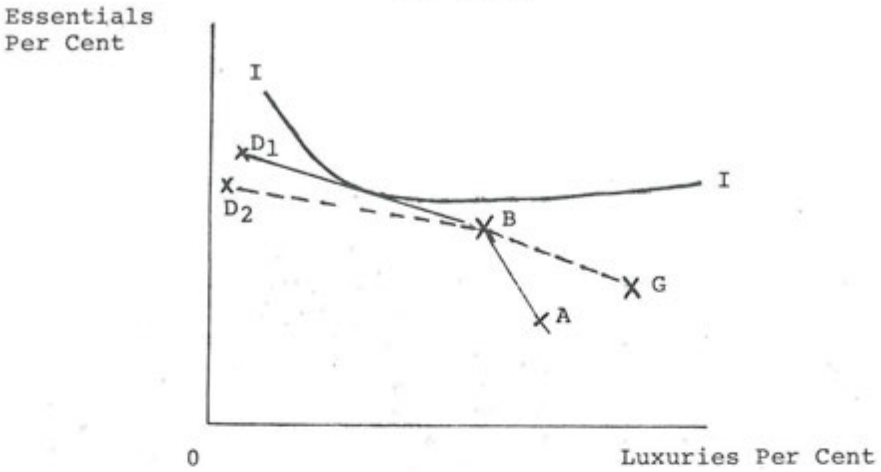
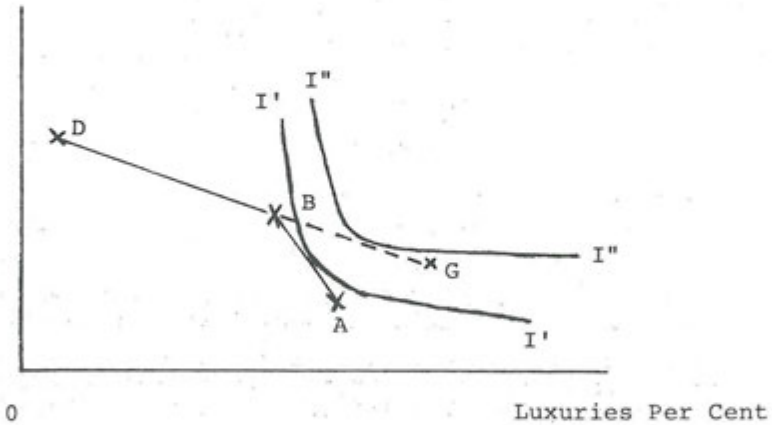


FIGURE 3



Essentials Per Cent FIGURE 4



ments" on the other, where essentials are defined as those for which there exists a zero or very low income-elasticity of demand, and luxury characteristics those in which there exists significant such income-elasticity. (One could readily enough alter the definition to suit the preferences of the planner, if one chose, so as to incorporate such "good" characteristics as protein in foodstuffs as "essentials", or such "bad" ones as addictive quality in "luxuries", regardless of the observed income-elasticity of demand for these characteristics). It will immediately be apparent that there may be powerful distributional (and therefore social welfare) effects emanating from changes in consumption technology.

Figures 2 to 4 portray changes in consumption technology in terms of "essential" and "luxury" charactristics of a set of products, all of which alter income distribution to the disadvantage of the poor. The indifference curves II and II' depict the tastes of the typical poor person and the typical rich person respectively. Products D, B and A constitute the original consumption technology, to which is now added product G.

In diagram 2, the disappearance of good D or B, with the introduction of a new product G, lowers that part of the efficiency frontier

which is relevant to the poor and absolutely lowers their welfare. In diagram 3, the impact of the new product is such as to raise the price of the old since it has captured some of the market and lowered the scale at which the original product is produced, thereby raising its cost. Again, the effect of the shift in the consumption efficiency frontier is absolutely to lower the welfare of the poor. In diagram 4, all of the gains from the appearance of new products accrue to the rich and the losses to the poor are only those of relative deprivation - reduction in income share.

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Comment on Helleiner's Paper - Gustav Ranis

In assessing studies on the pros and cons of the MNC with respect to technology transfer and adaptation there has been a failure to take into account differing environmental conditions in evidence in each case. It seems to me that "good behavior", from the point of view of appropriate technology and output mixes, is highly correlated with more competitive environments which force the abandonment of the "quiet life"; on the other hand, when, due to protection etc., large windfall profits are available to MNC's - as well as to the large domestic firms - both output mixes and technology chices are almost certain to be inappropriate. Companies which can make 30%-50% profits regardless of their adaptability to local conditions are unlikely to "watch around" for possible innovative departures.

If we are dissatisfied with the inward-looking and capital-intensive structure of MNC's, and of the industrial sector generally, we have a choice of getting the state to intervene directly by pressing the companies to export more, change their technologies, and change their output mixes - or to move gradually towards a lower level of protection resulting in a reduction of windfall profits and the enforced search for more appropriate technology and output mix choice. The first alternative leaves the temperature in the industrial hothouse basically unaffected and tells the MNC, e.g. in automobiles, to export more - in exchange for which they are permitted to keep making unearned profits in the protected domestic market. In this way better export performance, it is claimed, can be assured, as well as changes in technology and output mix. But there are two problems with this approach - one, exports are "pushed out", via subsidization, giving the company its "required" profits and the balance of payments its "required" exports, but possibly at a large cost to the economy since it may have been accomplished by the expansion of a highly inefficient industry even with negative value added at international prices. Such "crimes" can be committed in the cause of export promotion, i.e. the artificial expansion of capital-intensive and inefficient industries directed towards exports, just as well as in the name of import substitution. This, for example, has been happening in South Korea in recent years. Secondly, and related, this alternative takes for granted the capacity of government officials, sitting around a table - and given the best intentions - to determine just what technologies, output mixes, export patterns etc. should be established. More than likely, the decisions and outcomes will be quite arbitrary, and the determination as to which MNC's to pressure and to do precisely what left to negotiation.

The second alternative is to gradually reduce the protective cover surrounding the industrial sector, while at the same time making the (reduced) levels of protection more even-handed as between import substitution and export activities. Such gradual withdrawal of protection would force industrialists to take out paper and pencil and adjust their output and technology choices in order to survive. Consequently there would result a restricting of output in directions more and more in keeping with the country's resources, and leading to a substantial natural expansion of labour intensive industrial exports competitive in international markets. This second approach needs to rely less heavily on specific or direct government action and proddings, but very much on government's general ability and

willingness to evolve an indirect strategy of gradually reducing levels of protection and monopoly power while providing adjustment assistance to severely affected firms and workers in the old import substituting industries.

With respect to Professor Helleiner's discussion of "consumption technology", I am very much in sympathy with the thrust of his paper here but am a bit concerned as to where "induced tastes" (via advertising etc.) end and where adaptive goods begin. After all, we can readily agree with the social waste implied by advertising but there remains a very touchy point concerning "utility and all that." For example, one would hate, even if one could, to tell an LDC's population that it "should" produce only one kind of a shirt (as the Soviet Union used to) or that an open-toed sandal is "better" than Western-type shoe. One should rather, it seems to me, concentrate on making sure that full information on all alternatives is available and that there is sufficient workable competition so that advertising is "naturally" reduced and relative prices (of shoes and sandals) more nearly reflect relative costs.

6

IMPORT OF CAPITAL GOODS

KRISHNA D. N. SINGH

A significant feature in the balance of trade of a number of countries today is the volume of imports of capital goods in certain countries and correspondingly, the quantum of exports of such machinery and equipment by others. Capital or producer goods, in this context may be deemed to cover mechanical (non-electrical), electrical and transport equipment, together with the principal components and parts thereof, which are utilised as machinery and equipment in various production and manufacturing sectors.

2. The production of fabricated metal products, machinery and equipment registered a sharp increase in the 1960s. In the developed economies, production in this category (ISIC 38) rose from $134.6 billion in 1960s to $291 billion in 1970 while in the deveoping countries, production rose from $3.8 billion to $9.6 billion, the latter figure, however still constituting only 3.2 percent. The volume of trade in machinery and transport equipment (SITC commodity group 7) also rose rapidly in these years and total exports of such equipment increased from $27.7 billion in 1963 to $89.6 billion in 1970.[1] Almost the entire volume of such exports during 1960-9 was from developed countries, with over 85 percent from the developed market economies, about 13 percent from centrally-planned economies, and only about 1 percent from developing countries.[2] In quantitative terms, out of a total trade of $89.6 billion in 1970, exports of machinery from developed market economies were of the order to $78.5 billion, from centrally-planned economies $9.8 billion and from developing countries $1.3 billion. While most of this trade was between developed countries (77 percent), the volume of machinery exports to developing countries in quantitative terms rose from $8.02 billion in 1960 to $19.3 billion in 1970, constituting 33.4 percent of all imports by the developing countries in the latter year. With the increased tempo of industrialisation in this decade, there will be a further acceleration in demand for capital-goods in developing countries. In this paper, it is sought to highlight some of the significant trends and implications of such increased demand and consequent increase in imports of machinery and equipment.

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1) U.N. Monthly Bulletin of Statistics. Quoted in U.N. Industrial Development Surveys. (Volume I-V) Figures related to FOB exports.
2) In this paper, the classification of developing countries, developed market economies and centrally-planned economies follows the classification of countries adopted in the U.N. Bulletin of Statistics and other U.N. publications.

3. Apart from the direct impact on balance of payments, which is severe in the case of many developing countries facing acute foreign exchange constraints, the continuing dependence on capital goods imports by most developing countries has significant technological and socio-economic implications. The capital goods sector not only covers a very wide segment of manufacturing activity but is also indicative of significant stages in industrial growth. Such growth normally follows a fairly uniform pattern in relatively free market economies, tending to concentrate initially on machinery repairs and production of non-durable consumer goods and simple machinery, components and spares, besides basic industrial raw materials and intermediate products, for which adequate internal demand is assured. The transition to the next stage viz that of production of more sophisticated machinery and components, for which there may be adequate internal demand and export prospects, is far more difficult and usually requires considerable effort and programming. Because of sophisticated technological requirements and the complex nature of production in the engineering goods industry and the heavy machine building sector in particular, the latter stage can get delayed indefinitely despite sufficient economic justification, if left to market forces alone. This may not of course have much immediate relevance in a number of developing economies, either because of size or level of development or specific factor endowments and circumstances. However, the problem does assume great significance in the case of number of countries in Asia, Africa and Latin America, which have growing internal markets of reasonable size and which are at various levels of industrialisation. In these countries it must be considered whether more deliberate efforts need to be made to channel investment resources to the machinery manufacturing sector. It may well be, as perhaps in the case of Brazil, that relatively little intervention by the State or institutional agencies may be called for, except in the form of promotional policies and incentives. Or, it may be necessary, as in the case of India, to ensure that scarce resources are directed to priority sectors such as capital goods production in the form of direct investments through public sector projects for heavy mechanical and electrical equipment manufacture. In some countries, indirect measures and policies may suffice to correct any inbalances in the industrial growth pattern as may be necessary while, in others, more direct measures for resource mobilisation and channeling may be necessary. Irrespective, however, of the nature and extent of policy and other measures, what is important is to assess industrial growth requirements and the prospects and possibilities of domestic capital goods production.

4. To assess the overall quantum of capital goods imports to developing countries, some order of-magnitude projections can be made of demand and anticipated imports. An indication of the projected requirements of capital goods in these countries can be obtained by projecting the increase in manufactured output to 1980 and thereafter applying a similar ratio between manufactured output and demand for machinery and equipment during previous years. While this is undoubtedly a simplistic approach and does not provide for a number of important variables such as the time lag in machinery installation and variations in the machinery-output relationship for different sectors and levels of growth, it nevertheless enables a broad assessment of the magnitude of the problem. Manufactured output in developing countries is assessed to have increased from $26.9 billion in 1960 to $51.5 billion in 1970.3) On an assumed annual

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3) U.N. Industrial Development Survey (Volume V). "Manufacture" includes industry groups listed in Major Division 3 of ISI classification of all economic activities and includes both light and heavy manufacture.

growth rate of 10 percent, this figure would increase to $134.4 billion by 1980. The total demand for machinery and equipment, as represented by imports and domestic production in the machinery and metal fabrication sector rose from $11.82 billion in 1960 to $28.9 billion in 1970.[4] If a similar relationship, as existed between total manufactured output and overall machinery demand in 1970, is projected for the year 1980, the total requirements of machinery and equipment in that year would be of the order of $75 billion. In terms of unit investment costs on machinery and equipment as related to unit output value in 1970,the ratio works out at 0.56, which has also been assumed for the year 1980.[5] As for domestic manufacture of machinery and equipment, the growth rate for the 1960-70 period was slightly less than 10 percent ($3.8 billion in 1960 to 9.6 billion in 1970) and assuming a somewhat higher growth rate of 11 percent for 1970-80, production by 1980 can be projected to reach $27.4 billion. This would still leave a balance of about $47.6 billion to be covered by imports from developed economies unless domestic manufacture in developing nations can be substantially accelerated. Part of such imports may be covered by trade between developing countries but the overall shortfall would still continute to be of this order unless the assumptions are substantially modified. It must be added that since the projected figures are at constant prices, the actual import bill on this account would be much heavier and may well reach a level of over $70 billion by 1980. This is likely to prove a staggering burden for the developing economies. While the growth rate for manufactured output is not likely to fall below 10 percent, the rate of 11 per cent for the machinery and metal fabrication sector may not be easy to achieve and to the extent of any shortfall, the import burden may increase still further. It is difficult to visualise the extent to which this growing import liability can be offset by increases in the volume and value of traditional commodity exports, with the notable exception of course of oil. It is, however, more likely that any increases in commodity export values will be more than compensated by increases in cost of industrial materials and equipment, consequent on the rapid price escalation of oil and other energy sources.

5. The impact and implications of projected machinery demand and imports has received considerable attention in many developing countries. Projections of such demand and imports, particularly in important sectors, were made for Brazil and some other Latin American countries, during the 1960's. In countries like India, where there has been a considerable degree of planning over the last two decades, fairly detailed projections are available on a continuing basis. Recently, a study undertaken in Mexico jointly by the UNIDO and Nacional Financiera, projected capital goods demand and imports (excluding the transport sector) for Mexico for the period 1976-1980 1980.[6] Sectoral studies have also been made in some other developing countries, but relatively few countries have made a comprehensive analysis of the capital goods sector as a whole, in terms of overall machinery requirements over a period of time as related to possibilities of domestic manufacture. Such an analysis has to be on a continuing basis and undoubtedly requires a degree of sophisticated planning but the prospects of rapidly increasing imports, both

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4) Domestic production refers to machinery and metal fabrication covered in ISI classification group 38.

5) This ratio can be viewed in relation to the weighted average figure of 0.52 indicated in "Projection of demand for industrial equipment" an UN paper presented to the Meeting of Experts on Capital Goods organised by ECE in Geneve in February, 1962.

6) Report of UNIDO-NAFINSA Group on Capital Goods Development--Mexico (Phase I-B) UNIDO, 1973 unpublished.

of original equipment and components, spares and processed materials necessitate such a study as an integral feature of industrial planning. The qualitative and quantitative implications would naturally vary from country to country, depending both on demand and absorption rate for machinery and equipment and on domestic investment programmes for the machine-building sector. The fact that machinery costs have increased considerably in recent years and are likely to increase even faster in the future is an additional factor of importance. It is estimated that more than one-third of the increase in dollar expenditure of developing countries for capital-goods between the late 1950's and early 1960's resulted from the rise in price of these goods.[7] From 1968 to 1972 the price rise has been even greater and has averaged 5-6 percent annually for a number of categories of equipment, followed by a probable rise of 15 to 20 percent in 1973 alone, for certain types of equipment.

6. Against the increased volume and cost of capital goods imports, there has been a dramatic rise in machinery manufacture in some developing economies such as Brazil, India, Taiwan and the Republic of Korea, while a number of machine-building projects have been implemented or are under implementation in other countries including Egypt, Pakistan, Thailand, Iran and the Philippines. The growth rate in respect of fabricated metal products, machinery and equipment was 9.2 percent during 1960-70 for developing countries as a whole. In some cases, as in Egypt and India, a relatively high growth rate was achieved through direct channeling of investment resources for this sector, through state-owned enterprises. In other cases, local factor advantages and circumstances have generated considerable inflow of private capital for machinery industries, so as to meet rapidly growing internal demand as in Brazil or for exports as in the case of Taiwan, the Republic of Korea and the island economies of Hong Kong and Singapore. High labour costs in Western countries and lately in Japan is resulting in increased movement of investible resources and technology to less developed regions, particularly in more labour-oriented branches, which could include production of wide ranges of parts and components for the machinery sector. In the larger developing countries the high degree of protection, often in the form of import controls and insistence on partial domestic manufacture has also been an important contributory factor to the growth of some capital goods industries, though such growth tends to be patchy where it is unrelated to a planned development programme for this sector. These trends will continue and, during the seventies, it can be reasonably expected that capital goods development will continue at least at its present pace and the growth rate may even be higher as emphasis on import substitution extends over an expanding demand base for machinery and equipment. The unplanned growth of this sector would, however, constitute only a partial answer and may give rise to other problems relating to productive efficiency.

7. It must be recognised that the process of import substitution in capital goods development, though fairly successful in its early stages cannot, in most cases, be economically pursued beyond a point unless internal demand growth is high and sustained over a reasonable period of time or the possibilities of exports are taken into account. Even when domestic markets are sizeable and growing rapidly, other factors such as economies of scale, access to and absorption of technological developments and innovation and productive efficiency in terms of international competitiveness over a period of time are vital determinants of the economic limitations of import substitution. It is only when these conditions are fulfilled over a period of time that machine building projects, which are initiat-

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7) U.N. Industrial Development Survey (Vol.1)

ed as import-substitution schemes are able to develop into partly export-oriented projects. Internal demand growth for specific capital goods subsectors is rarely sustained over an indefinitely long period and usually rises rapidly in the early and intermediate stages of industrialisation and thereafter tends to stabilise at a lower level over a period of time. By this stage, domestic capital goods production must be able to compete effectively in international markets. Such competition is extremely keen as global manufacturing capacity in many machine-building subsectors, such as heavy electrical equipment, is often more than adequate. At the same time, the factor advantages in many developing countries, particularly cheap labour and sizeable internal markets, could enable their effective entry into this field, provided the criteria of efficiency and competitiveness over a period of time are recognised and fulfilled.

8. Any import substitution programme in this sector needs, therefore, to be carefully programmed. While an essential starting point is the projections of demand for various categories of machinery and equipment over a 5 to 10 year period, the specific capital goods branches where domestic production can be efficiently undertaken need to be carefully identified, together with the extent to which import substitution in terms of phased domestic integration may continue to be of comparative economic advantage. Indiscriminate efforts for import substitution in all branches or of all types of components in early production stages can have adverse repercussions in the form of high manufacturing costs and productive inefficiency. This can be due to a combination of many factors. The growth of internal demand, together with initial export prospects may be quite inadequate for indigenous production on an economic scale, resulting in idle capacity. Or, the pressure for such substitution may lead to the import of obsolescent, second-hand plants, whose capacity is unrelated to local production requirements. The availability of indigenous technical skills may not be adequate for manufacture of sophisticated components without well-planned training programmes. In some cases, the related technology may not be appropriate or may incorporate undesirable and restrictive tie-in and other contractual provisions. The basic processed materials may not be available in many cases and may require backward linkages to be planned simultaneously. To these factors, all of which may lead to higher production costs, must be added the policy implications of a higher degree of protection in the form of import controls. Operating within protective import barriers, the cumulative effects of these factors are further accentuated because of lack of competition. These factors do not detract from the basic need for developing capital goods production; they only highlight the need for careful programming, so that such production can achieve economic and efficient levels and can stand the test of international competition within a reasonable period.

9. Apart from the balance-of-payment implications of capital goods imports, the growth of the machine building sector needs to be viewed as an essential stage of industrial growth and technological progress. Machinery imports directly serve as a training grownd for human resources in these countries and, from this viewpoint, constitute an important vehicle for technological trade. The transition from machine-operation skills to machine-building capability can be effectively bridged within a reasonable period, provided suitable technological assistance and systematic training is provided in the early stages. There are a number of instances of sophisticated machinery products produced in developing countries competing in international markets within a few years of starting manufacture. Significant examples are the exports of complete cement plants, heavy electrical equipment and 120 MW boilers from India

to other Asian countries; machine tool and heavy equipment exports from Brazil to other Latin American countries; flour milling equipment from Mexico and certain categories of electrical and electronic machinery and components from Taiwan, the Republic of Korea and Hong Kong to various countries. The actual period required to bridge the gap in manufacturing capability depends on various factors, among the most important of which is the nature of technology secured and the facilities for rapid absorption of such techniques. The international market for technology in the capital goods sector, though fairly limited, is not tightly knit, except in certain highly sophisticated capital goods and developing countries have a degree of choice in selection of appropriate manufacturing techniques in this sector. In India, for example, a number of heavy machine building projects are based on technology from the Soviet Union and other COMECON countries. Technological obsolescence also tends to be relatively slower in this sector than in many process industries, though acquisition of technology should be such as to enable constant access to, and inflow of, latest technological developments. From this viewpoint, the "joint venture" concept represents the most appropriate corporate entity, as capital participation by technology suppliers would ensure both the effective transfer of technology, and the continuing access to technological innovations. These aspects can be provided through license agreements also, but are more difficult to ensure in fields involving complex manufacturing techniques.

10. It is necessary to consider capital goods production as being essential for the development of indigenous skills and the building up of skilled manpower resources in more sophisticated and precision manufacture. The relatively higher application of the labour factor in machinery manufacture, as compared to sophisticated process technologies in other sectors, also results in greater employment opportunities, both directly and in the manufacture of sub-assemblies, components and spares. The manufacture of heavy machinery and equipment also brings, in its wake, considerable expansion of the engineering goods sector and can play a key role in the development of a wide range of metal fabricating industries. It can also serve as a base for absorption and future adaption of technology and production techniques in a number of production branches. The growth of technological service facilities such as detailed engineering, which constitutes a major gap in many developing countries would also receive a fillip with the expansion of the capital goods sector. In fact, lack of emphasis on this sector can lead to a decline in technological development over a period of time, and under-utilisation of domestic factor resources, particularly manpower, apart from the fact that a very broad and diversified field of production may be left uncovered.

11. The determination of an appropriate pattern of capital goods development at a particular growth level, is however, a complex task and requires a comprehensive, selective and coordinated approach. Since a large segment of the metal transformation branches is covered by this sector, there is a very wide area to choose from, in the context of a country's factor circumstances. It is obviously not possible to prescribe any uniform pattern for such sectorial growth in the developing economies. Conditions are divergent, both in terms of factor resources and levels of development, and programmed growth of this sector must be considered in different stages, depending on such factor considerations. Initially, efforts have to be concentrated on the development of facilities for repairs of existing machinery and transport equipment, including automotive equipment. Together with repairs, the manufacture of simple spares and parts which require constant replacement can be undertaken. This stage has already been achieved in most developing regions.

Mexico, for example, earns considerable foreign exchange in the repair of machinery and manufacture of simple machine parts. Following this initial development stage, it is possible to delineate a general process of evolution of machine-building facilities. The process can be hastened or retarded by a number of factors, among the most important of which is the proper orientation of governmental policies towards imports of machinery on the one hand and programmed growth of efficient indigenous machine-building facilities on the other.

12. The capital goods sector can be considered under two principal categories; mechanical, including transport, equipment and electrical equipment. Mechanical equipment covers a very wide range. In the early stages of development, simple machinery and equipment intended to produce consumer products of various types can be manufactured and thereafter more difficult items of fabrication and manufacture can be gradually introduced, constituting what may be termed "equipment of common use" the more important lines of which are as follows:

(i) Castings, forgings, gears, standard parts, tools, etc. which can also be viewed as infrastructure industries for the growth of this sector.
(ii) Pumps, centrifuges and compressors
(iii) Lifting, loading and conveying equipment
(iv) Construction equipment
(v) Machine tools, chip removing and chipless forming
(vi) Diesel engines, industrial turbines, etc.
(vii) Simple pressure vessels, process control equipment and other welded plate work and implements.

Most of the above items of machinery are required for the growth of industrial and agricultural activity in any developing country, but there can be a large difference in the scope and range of products required at any particular stage. Broadly speaking, in the initial stages, only simple types of machine tools, small-size pumps, compressors, diesel engines are required and, in turn, the castings, forgings, gears and tools needed are also relatively unsophisticated. As the tempo of industrialisation grows, the larger and more difficult items and ranges can be taken up for manufacture. The production programme for more sophisticated machine tools and other machinery and equipment specifically required for various industries will, however, depend on the adoption of a coordinated programme of large-scale industrialisation covering specific industries such as iron and steel, cement, sugar and food processing, pulp and paper, petroleum and chemicals, mining and metallurgical industries, together with the development of the automotive and transport sector and transport facilities, including highway construction, railways and shipbuilding. The growth of the equipment industry will depend on the projected development plans for these and other sectors and any programming of machine-building manufacture must follow the programming of development of these branches together with production sectors such as agriculture, public works, etc. besides a large range of consumer goods industries, all of which together determine the size of the domestic market for equipment. In developing countries, in which capital goods industries have developed considerably, the general pattern has been to start with "assembly" operations and gradually develop local production, both vertically in the same production unit or through backward linkages with other producers of components and parts. In some cases, the linkage growth has been very satisfactory and a high degree of domestic integration has been achieved with major inputs being reasonably priced. In other cases, either there has not been any suitable development of linkage units or input costs have tended to be high for one or other of the reasons indicated earlier.

13. As for electrical equipment, a high proportion is required by the electricity supply undertakings (possibly 70 to 80 percent in value) and the rest by industrial, commercial and domestic consumers of electricity. The growth of this industry in many developing countries, appears to have taken place in three stages. In the first stage, electric supply has been derived from a number of local generating stations serving the distribution system in the nearby towns and villages and the demand for equipment is mostly for distribution lines and for small industrial and other consumers. The equipment needed comprise distribution transformers, poles, insulators, conductors, switches, fuses, insulated wires, bulbs, and small and medium motors and starters for electric pumps, food-processing equipment such as flour and oil mills, and small workshops. In the second stage, the source of power generation shifts to hydroelectric sites and to large-size central thermal stations which are connected to load centers by long transmission lines. At the same time, industrial and commercial consumers take to more intensive power-consuming processes, using medium-size electric motors (say 50-500 HP) for refrigeration, heating and other processes. The transmission line equipment includes medium-size power transformers (500-10,000 KVA), switchgear (11 to 33 KV), simple type power lines, cables, etc. The technical skills, investments and technological know-how required in the above two stages are not of a high order and many developing countries have reached this level with comparative ease. Although most of the difficult items such as power generation equipment and sophisticated industrial drives are imported, considerable development has been achieved in producing most of the other equipment, together with durable electrical consumer goods. The third stage covers the manufacture of heavy equipment, such as power boilers, turbines, generators, transformers and circuit breakers for the increasingly large size of central power stations and the very high voltage grid systems. At the same time, electrical equipment required by large industries become increasingly sophisticated such as motors in the range of 1,000-10,000 HP with versatile process control equipment for steel, cement, paper, mining, metallurgical, chemical and petroleum industries. The decision to set up manufacture of the above categories of equipment would naturally call for careful consideration of all related aspects, such as the size of the market (including export prospects), the level of technical skills, the availability of industrial raw materials, the availability and cost of capital, and the selection and acquisition of the most appropriate technology. The long-term success of these enterprises would depend upon the ability to master and absorb the technology in the shortest possible time and keep abreast of further improvements through adaptation and by research and development conducted by local scientific and technical manpower.

14. Both in respect of mechanical (including transport) and electrical equipment, domestic equipment manufacture can adopt different patterns, depending on the stage of growth. At each growth stage, it is possible to broadly define the principal production and technological gaps in the economy in respect of equipment requirements. Once the sectoral production and technological gaps have been identified, some general criteria of selectivity can also be applied to determine the manufacturing potential of various capital goods products. These include considerations such as: (i) machinery items, including components and spares, which have a high labour content, (ii) products that can be produced with technological efficiency at relatively small scales of production and which do not require sophisticated production lines, (iii) capital goods whose intermediate components are already produced or can be manufactured on an economic scale and at reasonable cost, (iv) machinery items using raw materials produced in the country at reasonable cost, (v) products having less likelihood of rapid technological ob-

solescence, (vi) products which have substantial export potential and (vii) certain capital goods items whose domestic production is considered essential for overall industrial growth. Consideration of the above aspects would be necessary both for export-oriented manufacture and production designed mainly to meet domestic requirements, as the latter should also be developed primarily in respect of items for which the country has a comparative advantage. At the same time, there may be certain producer goods items, the domestic manufacture of which may be considered necessary for reasons of policy or for achieving a greater measure of domestic self-sufficiency in critical fields from a national angle.

15. While the general criteria can serve as useful indicators, capital goods development has to be related to specific machinery products or groups of equipment. This presents a series of complex problems. Demand estimates for various categories of machinery based on growth projections of the principal machinery user sectors, are extremely difficult to project over a reasonably long period, in view of inadequate data. The application of growth models for the user sectors and value projections of the major machinery categories in each sector through the use of co-efficients of unit investment costs as related to unit value of output, yields useful results but needs to be constantly cross-checked in the light of actual experience. After initial identification of the groups and items of equipment which present scope for domestic manufacture, detailed pre-investment studies are necessary to determine the feasibility of any of the projects initially identified. Side by side, an active programme of investment promotion has to be undertaken. Most capital goods manufacture involve sizeable capital outlay, together with long gestation periods, during which there is little return on capital, and private capital may initially be reluctant to invest in this sector in preference to consumer industries and other more lucrative and quick yielding investments. It is also necessary to overcome the initial reluctance of domestic user sectors, including governmental user agencies, to purchase indigenously-manufactured equipment, which would also probably be more expensive in the early years of manufacture. The development of suitable supply sources for key inputs such as processed material, components and parts may present serious problems. In early stages of domestic integration, the co-ordination of production comprising the import of certain components and parts with domestic manufacture of others is extremely difficult.

16. The above aspects necessitate a pivotal role on the part of governmental authorities, both in the planning and in the implementation of any capital goods development programme. The complex nature of capital goods production, the longer gestation period that is involved and the multifarious aspects that require continuing analysis and co-ordination, warrant that the growth of this sector should not be left to market forces only. In most developing countries, governmental agencies do play a fairly active part in planning or co-ordination of industrial growth. This is all the more necessary in the case of the machine building sector and institutional agencies for planning and financing need to be closely associated not only with the initial projections and identification of machinery products to be manufactured, but also with the successive stages of resource mobilization, selection of technology, determination of the levels and patterns of domestic integration, pricing of final products in relation to comparable imported products and the development of input industries. Various policy issues also need to be resolved such as sources and costs of capital facilities allowed for machinery imports, the degree of protection through import controls or tariffs and the period of such protection, the incentives for export of machinery products, and the provision of technical education and manpower training facilities. Such policy aspects

need to be dovetailed to a much greater extent than in the case of other manufacturing sectors. Without effective planning and co-ordination, there is likelihood that this sector would not only grow at a slow and inadequate pace but also in a haphazard manner, resulting in heavy import burdens and in adverse consequences for the economy. Balanced industrial growth necessitates the growth of machine-building industries in developing countries on a pattern which bears a close and consistent relationship with the overall industrial growth pattern of each country. While the imperatives of trade balances, foreign exchange and domestic resources, and specific factor endowment considerations would determine the specific relationship in each country, the significance of the capital goods sector needs to be fully recognized in planning and co-ordinating future growth patterns.

Comments on Singh's Paper - Nak Kwan Kim

Because of economic, technological and industrial backwardness, any effort to develop manufacturing industries in developing countries often exerts pressures for importation of capital goods, mostly from developed economies. The magnitude and nature of sophistication of machinery and equipment which are to be imported will continue to be largely affected by its national industrial development strategy including export promotion and/or import substitution policies, the country's economic growth potential, industrial base already built and capability of producing quality capital goods at internationally competitive prices. On the other hand, accessibility of international credits, and availability of other forms of foreign aid and attitudes of aid receiving countries have been playing crucial roles in determining the trade pattern of capital goods. In any event, it is often observed that the developing countries may have to rely on imported capital goods for industrial development, so that rising trends of imports of capital goods may therefore be welcomed phenomena instead of matters of concern.

Greater attention should be focused on what sorts of manufacturing industries the particular countries should develop and how to maximize effective utilization of imported capital goods in order to attain faster yet sound economic growth through fully exploiting the economy's potential factors of comparative advantage. The imports of capital goods will undoubtedly continue to exceed exports of capital goods in the case of most developing countries, and it seems that such a trend might be accelerated if the countries continue to carry out rapid industrial development scheme of diversified mode.

The crux of the issues related to imports and/or domestic production of capital goods is whether the economy will be able to utilize them in the most efficient way for attaining economic growth at a rapid pace. Improvements of managerial skills and administration, availability of skilled workers and the nation's absorptive capacity for advanced technology are determining factors affecting the efficient use of capital goods. Imports of capital goods should be viewed in connection with the over-all economic development process. If the imports of capital goods effectively contribute directly and/or indirectly to the foreign exchange savings and generate employment opportunities at higher labour productivity, immediate unfavourable trade gaps resulting from imports of such capital goods should not be a great concern to the national economy. On the other hand, if the economy is efficient enough to export outputs produced with those imported capital goods, the problem of foreign exchange payments can be partially counteracted. Why should the developing countries rely on exports of traditional export commodities for payments of capital goods imports? I may add that careful programmes and projections of detailed demand for capital goods over the forthcoming decade do not hold the key to success or failure of the industrial development scheme.

Extreme complexity in composition of capital goods and rapid technological advancements in recent years make any reasonably acceptable exercise in programming and projection for detailed capital goods of a wide range virtually impossible. It should also not be

overlooked that numerous factors affect importation and/or production of capital goods. Interlinkages of one particular industry to the rest of the economy (both domestic and international) make such an exercise even more difficult. Rigidity derived from quantitative exercises should not bother the beauty of flexibility in the free-market system.

The most reasonable thing the developing countries could possibly do is that the government draw out general guidelines for development of the manufacturing industries and resort to monetary, fiscal and other economic development policy instruments and let the private sector take the initiative for development of capital goods and their related industries of manageable scale. The government's policy should be directed to induce all industrial units to be aggressive and highly competitive in both domestic and international fronts.

However, there are large scale industries which require huge amount of foreign exchange as well as domestic capital for development. Some of those industries may be essential and local markets are already well cultivated for outputs of those industries, but necessary financial resources can not easily be tapped from the private sector. A long gestation period might discourage involvement of private sector in such industries. In most of the developing countries the opportunity costs of capital are considerably higher than investment in such industries. It might be reasonable in developing economies that the public sector initiate those large-scale industries and turn them over to the private sector at an appropriate time. Many examples could be cited that private sector is found to be more efficient compared with the public sector.

7

OFFICIAL TECHNICAL ASSISTANCE AND THE THIRD WORLD

GERADO BUENO ZIRIBN

I. INTRODUCTION*

In this paper we intend to deal with official technical assistance which is granted by means of agreements between governments and that which is granted by international organizations. Military technical assistance, technical assistance between companies--including technology transfer and spontaneous scientific co-operation between researchers in different countries--remain beyond the scope of this paper. In addition, the paper does not deal with each and every aspect of official technical assistance. It mainly concerns assistance provided by capitalist countries and international organizations. It considers the role of technical assistance from the standpoint of the development of the scientific and technological infrastructure of developing countries. When we speak of technical assistance, we are referring to the official kind.

Technical assistance officially originated more than a century ago, and, in addition to economic aid from the great colonial countries, was largely a continuation of long standing activities. However, they were conceived as such only after the colonies reached independence.

Technical assistance programmes became a part of the U.S. foreign policy only after the initiation of the cold war. For example, the Marshall Plan tried to forestall the "danger" that the progress of communist regimes represented to the capitalist world. They believed that technical and financial assistance would contribute to economic development and political stability, thus preventing the infiltration and spreading of ideologies contrary to the interest of the so-called "free" world. American technical aid was not limited to Western Europe; it also flowed toward less developed areas.

President Truman spoke about technical assistance as an endless flow of technological resources and scientific advances from the United States that would constantly mesh with the efforts of LDC's and stimulate the development of their internal resources and the improvement of their standard of living.[1)]

However, the Korean War demonstrated the very essence of foreign

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* We are grateful to R.B. Wallace for his comments on the English version of this paper.

1) President Truman's Inaugural Adress, January 20, 1949.

aid programmes; technical assistance for development stood aside to make room for military technical assistance. The greater part of the budget for external aid was absorbed by military assistance, which then became one of the pillars of United States military strategy in foreign countries. American technical assistance was not buttressed until after the USSR appeared on the international scene as a donor country to the LDC's, during the late fifties.

In these years many studies and reports were published dealing with external aid and American technical assistance vis a vis the new independent states. The role and uses of aid programmes were variously interpreted in these studies. "Hopes and assumptions about the relationship between aid, development, political stability and world peace were rarely spelled out, but it was recognized that, in the end, an aid programme must serve the interests of American national security in a broad sense."[2)]

Technical assistance granted by wealthy capitalist countries--as well as economic aid and credits--is one of the modern methods for keeping Third World countries within the U.S. sphere of influence. It is not, as has been ideologically argued, a struggle for democracy and freedom, but on the contrary, is a defense of capitalism. An example is the interruption of American help to Chile--except for military aid--while the socialist government of Salvador Allende ruled the country, and its immediate renewal when a fascist regime came to power.

It should not be surprising, either, that the U.S.A. should offer nuclear assistance to Egypt, political leader of the region with the largest petroleum reserves in the world, and which had remained outside the U.S. sphere of influence for more than a decade.

Bilateral technical assistance, as other forms of 'development aid' usually follows the economic interest of the providing country. Two of the norms that determine foreign aid policies are to develop the production of necessary raw materials in the recipient country and to ensure a market for the donors' industrial products. Because of this, a considerable proportion of credits, aid and technical assistance are tied to equipment, intermediate materials and technology supplied by the donor country. In this way, aid is transformed into sales promotion and the development of the recipient countries is distorted by the creation of a dependent productive structure.[3)]

International organizations are influenced to a greater or lesser degree by the political strategy of wealthy countries. One of the most abrupt manifestations of this influence is the expulsion of Cuba from the Organization of American States, or the refusal of the Interamerican Bank for Development--because of 'technical reasons' --to grant credits to the Unidad Popular Government of Chile.*

The international organizations and advanced capitalist countries have propagated a conception of development adopted by many Third World countries, according to which the increase in the gross national product is the main goal, while national autonomy, the distribution of income and the standard of living are secondary aspects.

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2) G. Ohlin, "The Evolution of Aid Doctrine". in J. Bhagwati and R.S. Eckaus, Foreign Aid, Penguin Books, England, 1970, p.29.

3) In this respect consult P. Drucker, an American consultant, "America Becomes a Have-not Nation" in R.A. Goldwin and H.M. Clor, Readings in American Foreign Policy, Oxford University Press, New York, 1971, pp.556-568.

* This could not happen in organizations of the U.N. where the socialist countries are represented and the LDC's have relatively greater political weight.

This conception of development tends to transfer technology and product organization from consumer societies to Third World countries, thus stimulating an imitation of their way of life. Experience in the Third World shows that economic growth itself is slowed, sooner or later, by the unjust concentration of income, the exhaustion of natural resources, the ignorance of the masses and the pseudoeducation of the elites.

Many of these countries are ruled by traditional oligarchies, whose principal interest is to maintain this state of economic and technological dependence in which they thrive. Some of them even have resisted the reforms demanded by organizations such as the ALPRO as a condition for granting aid. Economic and technical assistance, as it is practised today, adequately serves the interest of the ruling oligarchies.

Nevertheless, Third World countries that seek to develop autonomously can benefit from external aid if, conscious of the interests involved, they decide to face them. United, they can alter the actions of international organizations. The actions of the wealthy countries are, by their very nature, more difficult to modify, and require negotiation tools of greater power. The fact that rich countries depend, to a greater or lesser degree, on products of the developing countries gives the latter a potentially powerful tool of negotiation as was shown by the Arab countries in the case of petroleum.

Official technical assistance will play an important role in the development of Third World countries only if it is channeled toward the creation and strengthening of the educational, scientific and technological infrastructure in order to develop the capacity for absorption, adaptation and production of technology. This requires a new approach to technical assistance programmes both regarding the donor countries or organizations and the recipient countries.

Before dealing with this subject we will discuss the problems that official technical assistance programmes face today.

II. THE PROBLEMS OF OFFICIAL TECHNICAL ASSISTANCE PROGRAMMES

Since the beginning of technical aid programmes it has been stated that their goal is to eliminate assistance and put recipient countries on a self-sustaining basis.[4] However, this goal was clearly utopian concerning technical assistance in itself, as has been demostrated by more than 25 years' experience in this field. Not only has this goal not been reached, but the technological dependence of developing countries has become acute.*

How can we explain this phenomenon of growing dependence despite increased amounts of technical assistance?

We shall first proceed to compare official technical assistance in relation to other channels for the transmission of knowledge

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4) See documents about technical assistance by the United Nations and the Organization for Economic Co-operation and Development, and Friedman M. "Foreign Economic Aid: Means and Objectives", in J. Bhagwati and R.S. Eckaus, Op.Cit. pp.63-78.

* By technological dependence we do not mean a mechanical-causal relationship where external factors produce internal consequences. Dependence implies the interrelation of internal and external structural components. For a detailed conception of dependence, see F. Cardoso and E. Faletto, Dependencia y Desarrollo en America Latina. Siglo XXI Editores, Mexico, 1969.

and skills from the advanced countries to the Third World and then analyze some of the general and administrative problems that explain the continuation of dependence.

Broadly, one can distinguish between diffuse and captive knowledge. The former are freely accessible, and are transmitted by means of print, education, and personal contacts. Captive knowledge is sombody's property and access to it has to be purchased. Personal skills constitute a third and distinctive category: knowledge embodied in a human being. The skills that are important for technological development are embodiments of both diffuse and captive knowledge, the latter being acquired by experience, and is the most important for economic development.

Official technical assistance programmes consist mainly of transfer of experts, scholarships and other forms of training. They do not usually transfer captive knowledge except in the case of that supplied by socialist countries; this usually forms part of investment projects. This peculiarity is explained by the absence of private means of production in these countries and thus of the knowledge associated with said means. Training usually involves only the transmission of diffuse knowledge and the skills necessary to operate, but not to reproduce, technology. Missions of experts can transfer knowledge if they are involved in training of local personnel. But if they are dedicated to solving a problem by applying their skills, they would have rendered a service and not transferred knowledge. The personal skills that might be transferred are, in any case, of a much more limited value for development than corporate skills which are a form of captive knowledge. The analysis which is presented in the following paragraphs considers the scope and limitations of technical assistance provided by governments of capitalist countries and international organizations.

We proceed now to the forementioned general and administrative problems.

General Problems

a) The traditional conception of technical assistance is that of a tool for transferring know-how. This conception stems from the premise that underdeveloped countries lack technical skills and that they, therefore, require technical assistance to develop. The thesis is very much like the one that maintains that foreign investment and credits are essential for the development of Third World countries since they lack capital. The former as well as the latter deal only with part of the problem.

The authors that favor foreign investment do not explain the great economic surpluses that are absorbed by unproductive activities and those that favor technical assistance do not inquire why these countries have not been able to develop the technical knowledge they need so urgently. This conception implies also a fallacy that can be demonstrated by analyzing the dynamics of the development of technical know-how. Here, the process of mutual interactions between productive activities, the educational system and research plays a vital role. When these interactions arise in a framework of technological dependence what can happen, as is exemplified by the Mexican transformation industry, is the creation of a regressive circle: "the educational level of young students has had to descend because, (among other things), they do not need greater knowledge to control procedures and to oversee the obedience to norms, unless they take part in the process of formulating and establishing them".[5] The mechanical transfer of foreign technologies creates an obstacle to the development of technical skills because in this context they are not required.

Because of historical circumstances or by choice countries such as the USSR and China, that have relied on their own resources and knowledge, show that foreign capital and technical assistance are not essential requirements for development and that a static view of human capabilities is wrong. The important question, then, is that technical asssitance can only help technological and scientific development when this process is alive, internally generated and when foreign assistance does not become a palliative or a substitute, but complements internal dynamics as was demostrated by Japan.

In the abstract branches of the sciences, where there is no interaction with the productive system, it is possible to reach high levels of preparation but, owing to the scarce or nonexistent opportunities for research in developing countries, what happens is that the best brains migrated toward developed countries.

b) Technical assistance programmes do not stem from the needs of the recipient countries, but from the possibilities and interests of the providing agencies. The technical needs that developing countries have in almost every sector of their economies creates a pressure to accept the different offers of governments and international organizations. Many times the consequences are that the technical assistance plans or programmes of these countries are formulated according to the offers of the providers and not by an internal process of the recipient countries. Thus, technical assistance contributes to the imitation of development models where the principal objective is to increase production.

c) Technical assistance has not been incorporated in policies that conforms to the development strategy of recipient countries, and has been managed independently from other channels for the utilization of foreign knowledge such as technology imports. In addition, there has not been an organic relationship between technical co-operation and other forms of aid, particularly in the case of capital assistance. Since technical assistance is an essential part of capital assistance in the sense that its purpose is to train or provide people who will put capital to a better use, if this organic link were present, the effect of technical assistance would be enhanced.

d) Because of the political context where technical assistance has taken place, and because most of the Third World countries lack long term development strategies, technical assistance has been channeled chiefly toward relieving social, political and economic pressures, internal and external, with short run objectives. In this way the educational, scientific and technological infrastructure of developing nations cannot be strengthened, and no amount of technical assistance will overcome the technological dependence of these countries.

Administrative Problems[6)]

These refer chiefly to the lack of co-ordination between agencies in charge of technical assistance, the deficiencies of interna-

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5) Guillermo Haro, "El Desarrollo de la Ciencia en Mexico", Espejo, No.2, Mexico, 1967. Parenthesis added by the authors of this paper.

6) The problems of official technical assistance can be studied in: OECD, The Evaluation of Technical Assistance. Paris, 1969; United Nations, Study of the Capabilities of the United Nations System for Development. Geneve, Vol.II, 1969; and Stefan H. Robock, Brazil's Developing Northeast. A Study of Regional Planning and Foreign Aid, The Brookings Institution, Washington, D.C., 1973; Enrique Martin Campo's comments have been very useful.

tional experts and the lack of counterpart experts.

a) Lack of co-ordination and programming The administration of technical aid by the donor and recipient countries is the task of several departments or agencies that are not duly co-ordinated. This dispersion leads to repetition of functions and increases costs, thus wasting resources and frustrating potential results. Although there is a wide consensus of opinion regarding the need of reorganizing the administration of technical assistance by donor and recipient organizations, little has been done. The lack of programming causes most of the projects to be carried out independently one from the other. In addition, these projects lack a "previous definition of goals, instruments and expectations of success";[7] some are even contradictory.

b) International Experts One other serious problem regarding the administration of bilateral and multilateral technical assistance is the absence of administrative staffs highly qualified and capable of solving technical problems, analyzing needs, recruiting able experts and organizing highly efficient training courses and seminars.[8] The most frequently used means for providing technical assistance, up to the present, has been the international expert. However, besides professional experience, few of them have the ability to apply their knowledge in different situations as well as the capacity to transmit it by training local personnel. The problem becomes more acute because frequently missions of experts which should remain for a lengthy period co-operating with local personnel, leave too soon and, thus, are not able to assimilate the characteristics of the particular country involved. That is why their suggestions are often naive or inadequate. Many international organizations in charge of providing technical assistance pretend to fill this knowledge gap with a briefing concerning the socio-economic and political conditions of the recipient countries that in fact becomes a personal chat. The donor organizations face serious difficulties for recruiting high-level personnel. The reasons for this are, among others, inadequate wages, lack of vertical mobility in the organization, the absence of horizontal mobility to the private sector and weak "esprit de corps". The low level of the recruited personnel can be explained in part because many United Nations agencies are bound by rules that force them to obey national quotas while recruiting personnel. If the best of two prospects is a citizen of a country whose employment quota is oversubscribed, the other candidate will be the one chosen even if he has only the minimal requirements for the job.

c) International Expert versus Host Country Expert Given the deficiencies of international experts, it shouldn't be surprising that the efficiency of the relationship between them and the host country experts has caused serious doubts to arise. Suffice it to quote some of the opinions voiced in several Unied Nations studies where technical aid is evaluated: "The most important independent goal of United Nations' technical assistance is training national citizens to continue the task after the experts have gone away; that

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7) Naciones Unidas, Evaluacion de las Repercusiones y la Eficacia del Programa de Cooperacion Tecnica de las Organizaciones del Sistema de Naciones Unidas en Chile, Santiago de Chile, 1966, p.56 (E/4151/Add.2).

8) Robert Goldscheider's book, The Role of Consultants in the Technology Transfer Process. United Nations, New York, 1968, is quite useful for the establishment of rational criteria for the selection of international experts.

is, the mission of the expert is to be without a job; therefore, it is surprising that in very many reports the project leaders of the Special Fund have not mentioned the situation of counterpart personnel training".[9] It is curious the way this fundamental tool for the transmission of knowledge has been allowed to proceed at random, according to the opinions of each expert or of his national counterpart. It is surprising that throughout twenty years enormous sums of money have been spent without anybody wondering as to the efficiency of that instrument in comparison with other possibilities".[10]

"If the most disquieting element of this description is the lack of orientation, training and substantial support of experts, then it should be asked what is the value of the assistance provided by international organizations if their accumulated knowledge and experiences are not transmitted to developing countries by means of the exports."[11]

Briefly, when technical assistance is not a part of a coherent policy in which priority areas, goals to be achieved, and external and internal means for short, middle and long term action are not clearly specified, the results of such assistance can be very limited. In some cases they are even negative when the scarce internal resources of the recipient country are diverted towards areas lacking priority.

The donor organizations argue, with some reason, that the nature of technical assistance and its orientation towards the development aims of the recipient countries are inevitably influenced by the type of governments and agencies in charge of technical assistance in these countries.[12]

III. THE NEED FOR A TECHNICAL ASSISTANCE POLICY IN DEVELOPING COUNTRIES

A country can achieve rapid economic progress, as Brazil did in the 1950's, without relying on technical assistance.[13] However, policies regarding this subject, if rationally and coherently administered, can accelerate economic growth. Nevertheless, the creation and setting into motion of this policy is a very difficult task, due to the various and non-coordinated sources of technical assistance and because short-run political factors interfere in decision-making. Besides, the demands of the various pressure groups within the country compete against each other.

This establishes the need for a clear definition of national economic development priorities by the recipient country and, in this context, also the role to be played by technical assistance, so that they may be adjusted gradually to the development requirements of the productive sectors and subsectors.

To implement technical assistance policy, it is necessary to design a scientific and technological policy differentiated according

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9) Naciones Unidas, Desarrollo y Coordinacion de las Actividades de las Organizaciones del Sistema de Naciones Unidas. Informe de la Dependencia Comun de Inspeccion. Nueva York, 1969. E64698 E/AC. 51/31.

10) Naciones Unidas, Estudio sobre la Capacidad del Sistema de Naciones Unida para el Desarrollo. Ginebra, Vol.II, 1969, p.74, El subrayado es nuestro.

11) Naciones Unidas, Op.Cit. p.84

12) See OECD, Development Assistance, Paris, 1970

13) See Stefan H. Robock, Op.Cit. 1973

to the branch and sector of production that will be stimulated or strengthened.

The success of such policies will depend on their effect as a development catalyst; in other words, it depends on the stimulus that they create for technological absorption and local production of technology.

Whatever the difficulties might be, one must bear in mind that if technical assistance is not integrated with a national development policy, it could distort and frustrate a country's development efforts, particularly if it creates unrealistic expectations.

A technical assistance policy should include the following levels of analysis and issues, among others:

Levels of analysis

a) Definition of priorities Technical assistance priorities must be established in accordance with those of scientific and technological policy, and this latter must be linked to development policy.

This should be the logical sequence within which the technical assistance policy should operate. However, most of the developing countries lack explicit development scientific and technological policies. Some of these countries even turn to the source of technical assistance in order to identify their needs and to formulate their requests.

b) Analysis of resources To set a technical assistance policy in motion, it is extremely important to study the real and potential resources of the recipient country, both internal and external. Many technical assistance programmes have met with failure because of ignorance of these resources.

c) Co-ordination among the governmental agencies of the recipient countries The co-ordination among national departments in charge of technical assistance is a fundamental part of its administration. Such co-ordination would prevent duplication of functions within governmental agencies and within research and production centers. The assignment of functions to these agencies must be made taking into account the technical and administrative capabilities of each. Thus, the negotiation powers of the government are strengthened vis a vis the technical assistance donors.

d) Linking supply and demand The government should influence both the supply and demand of technical assistance through various incentives and regulations, favouring those programmes that satisfy the priorities established. It is also necessary to create systems that provide adequate communication between the centers requiring assistance and those that administer it.

e) Short and long-run Technical assistance policy, as all policies in scientific and technological matters, should essentially emphasize the long-run. This is so because training of human resources takes a long time and mainly because technology has long range effects on the organization of society. Disregard of the long-run usually implies, inadvertedly, the imitation of the way of life of consumer societies.

Issues

1. Technical assistance is successful only if it becomes innecesary after a reasonable period of time. It should contribute to the technical self-reliance of the recipient country and not only to economic and social welfare. If the country is not permanently better off when technical assistance is withdrawn, it will have per-

formed only a relief function. To play such a role, technical assitance should be directed towards the development of an educational, scientific and technological infrastructure in the recipient country.

2. Multilateral technical assistance and that originating in capitalist countries trains local human resources and provides personal skills for the execution of technical services. An important proportion of the experts sent, function as consulting technicians, for example in preinvestment projects. Many times their recommendations find their way into contracts of technological transference. It is evident that a high proportion of these consulting services can be substituted or complemented by an information system concerning knowledge which directs the search, selection and negotiation of technology according to the needs of the particular country in question and not according to the partial experience of said experts, however competent they may be.

3. LDC's must give high priority to technical co-operation among themselves. This co-operation has the following advantages in comparison to the provided by the rich countries. First of all, regarding their needs it is more adequate; secondly, it is freer of distorting political conditions; and finally, it serves to strengthen the self-confidence of the LDC's. For example, this can be done within the framework of creating multinational educational and research institutions and enterprises in which the rich countries do not intervene.

4. The less developed countries should exert pressure to shift the balance from bilateral to multilateral capital and technical assistance programmes. This shift would imply inherent technical and political advantages. The LDC's would influence more the direction of aid if it is centered within international organizations; multilateral programmes could function on a more permanent basis without suffering from political changes; finally, the allocation of assistance could be realized among countries on a more rational basis, thus coping with problems of a global nature and ensuring that assistance forms an integrated whole with development policy.

5. LDC's should only search for aid experts that remain in the country long enough to thoroughly train local personnel.

6. LDC's should not accept 'technical assistance' whenever it implies substitution of local personnel by foreigners, whenever it ties the country to inconvenient forms of technology or educational development and whenever it signifies ideological, cultural or military infiltration.

PART III

THE INTRA-NATIONAL DIFFUSION OF TECHNOLOGY

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THE DIFFUSION OF AGRICULTURAL TECHNOLOGY, THE ADAPTATION PROBLEMS

MIGUEL ANGEL CUADRA

The concern of evaluating the effects of technology on production is not new. The scholars of economy have long been concerned with these matters and in present times technology is considered capable of breaking static conditions through displacement of the production function. This, of course, indicates the importance of technological innovations; but it does not tell us how to diffuse this new technology and what will be the problems faced in its adaptation.

That we haven't found a satisfactory answer is clearly seen in the fact of inadequate growth of agricultural productivity in the so called Third World countries.

Even in countries which had a considerable agricultural development, and which occasionally served as examples, as is the case of Mexico, we have found, recently, a deterioration in the rate of growth of the sector, causing serious problems. The aforementioned happened when a few years back we considered that the production problem of the agricultural sector was solved, and that we should worry instead about over production in regards to effective demand. Likewise, a decade ago, most of the analysts thought that agricultural technology could be rapidly transplanted to the underdeveloped world, causing swift increases in agricultural production. Some years ago the term "green revolution" was coined, and it just so happens that our country, where it all began, is now facing production problems in its agricultural sector. It is true that we have identified one of the culprits of this situation, besides the population growth, over which little can be done in the near future. This is the bound character of agricultural production and the structure of ownership of land, which is unfavorable to development and a very risky political point. At least in Mexico it has been found that there exists a close relationship, between the growth of the agricultural sector and public investment for agricultural and cattle promotion. What we have not yet found, in my opinion, is how and where to focus the investment. This brings us close to the central point of the talk which I have been asked to give.

Before thinking about the problems of transmitting and adapting technology, I would like to point out several serious mistakes which we have incurred. One of these is the total lack of interdisciplinary works, and, characteristic of this, of being within our own specialized areas, possessors of divine truth and enlightenment. The result is that continually these enlightened people propose magic solutions, which in the end are very expensive, and result in a waste of resources in societies that cannot afford this luxury. Let me

give a few examples. The specialists in biological sciences proclaim as the absolute truth and only solution, the fact that not enough importance has been given to the development of improved varieties, adapted to local conditions. This results in the multiplication of experimental stations to begin, in a larger scale, a program for production and adaptation of new plants and varieties. The same happens in the case of the specialists in animal sciences. The aforementioned is only part of the problem. This situation is aggravated when we include the lack of coordination, and although both specialists belong to biological sciences, little is done to establish communication. Some can produce improved pastures, analyzing their results in the laboratory but not on the livestock itself, while on the other hand the others are feeding cattle on balanced rations in the laboratory, and not using the pastures that the first improved, because these are two different branch offices.

The social scientists, sociologists, anthropologists or combinations of these disciplines, whatever their name, according to their traditional habits, are less positive than the former in respect to solutions, and accuse them of being technocrats; of ignoring the special values that the traditional peasant keeps, and of exaggerating the importance of the technical change and economic incentives. They tend to encourage the somber criteria that no hope is conceivable until the whole structure of rural society is altered and its values changed by the diffusion of social or mass communications systems.

Others consider that the agrarian reform, or the reform of the agrarian reform, is capable by itself of solving all the problems, and in consequence become emotionally involved in these actions.

Occasionally, one of the enlightened proposes some other unique solution, and conclude, for example, that cooperatives constitute the best credit supply systems. Judgements, true or false, but lacking sense, for the evaluation of any policy should be within the context of the local conditions, and related to diverse political alternatives of regional or national character.

To this situation, already complicated, add in the scene of international "experts". Completely devoid of the realities of a country, callous to capture them, and in most cases, ignorant to begin with of the language, ready to solve the situation as soon as possible and from there, enlargen the horizons of its labor market. Absolutely sure that if it works in their own country, it has not reason to fail in the country they are in. When things do not happen this way, they easily escape the problem by putting the blame on the natives, who, without a doubt, belong to an inferior race.

Within such a chaotic situation, even the most intelligent, best intentioned political leader will tend to become confused, not to mention the peasants.

The aforementioned would be ridiculous if it wasn't unfortunately true. It is a fact, at least in Latin America, that in most cases the extension services have been bad copies of North American services, and until a short time ago measures have been taken aimed at their reconciliation with the realities of the different countries where they have to operate.

Would it be feasible to determine, in this situation, how to solve the problems of adoption of technology? It is possible, but it would be convenient to establish a prerequisite: That the national and local leaders be totally resolved to develop agriculture.

This is a necessary condition, but in no way sufficient. Within the difficulty that generalizations exhibit for this topic, the awareness of at least three facts should be established.

a) Given the complex traits of agriculture in the underdeveloped countries, physical, economical, institutional and motivational, and its interdependence with the other sectors of the economy, the generalizations for the economical changes, institutional and organizational, should be carefully investigated and subject to experimentation before establishing them within a national program.

b) The sustained growth of agricultural production is equivalent to agricultural development and consequently can be defined as a perfecting process of the structure. This implies technical, economic and political transformations, of attitude, and of the structure. Consequently, its intertemporary horizon is extensive. This implies that a unique and immediate solution is difficult. The process, even if everybody wishes to accelerate it to the maximum extent, will have to be slow. And if agricultural policy is to be continually subject to evaluations, to be able to correct its course if needed, continuity is indispensable; not the dramatic changes which sometimes occur owing to changes of administration or to political or merely personal circumstances.

c) The last point I wish to refer to, which has turned to be much more important in those countries that have solved the other two is this: "For some time now the agricultural economists have defined the agricultural problem as one of systems," this means that if agriculture is to function efficiently, it is a must to take into account not one or two or more problems, but a global view that may grant us the power to solve, a group of conditions of interdependent action. This presents the problem that, for an underdeveloped country, the possibilities of making an attack on all fronts due to the sector's complex problems may be impossible, owing to the limitations of either economic or human resources. In these cases, resources should be adequately assigned, and taken where the largest marginal return to investment is found. One of the facts that must undoubtedly be considered, as we have mentioned before, is the variety of conditions in which agriculture does flourish. This implies a series of interdependencies which make undesirable any generalization not backed up by research and adaptation experimentation. This is important, not only in the transference of technology from country to country, but even within the same country. We find a clear example of this situation in the so called "Plan Puebla".

One of the experiments that has drawn most attention, and has proven to be somewhat successful is the so called "Proyecto Puebla". The Proyecto Puebla is basically experimental, its objective is to create and prove ways of accelerating the yield of a basic crop--corn in this case--for those farmers that produce barely at a subsistence level; employing traditional methods. The objectives of this project are: 1) Develop, test in the field, and refine ways of speedily augmenting the yield of a basic food crop for the small scale producer; and train technicians of other districts in the components and successful application of such methods".

In the Centro de Economia Agricola del Colegio de Postgraduados de Chapingo (or Chapingo School of Postgraduates Center of Agricultural Economy) three pieces of research have been carried out on this plan, in order for the authors to obtain their master's degree on science.

The first of these, by Ing. Edgardo Moscardi, was presented in 1972. Its name is Irrigation and Transference of Technology: a Study for the case of the Puebla Plan. The author tries to analyze which is the origin of the factors of resistance that create a barrier for the transference of technology, and he starts by revising literature. He claims that some authors like Fromm, Foster and Erasmus, who have undertaken a careful analysis in Mexico of the resistance to change, have established certain hypotheses about its beha-

viour. Fromm, from the psychoanalytic point of view analyzes the traditional peasant's "Social character", defining him as a system of character traits, that develop to fit the social and cultural conditions akin to each social group. He starts out with the premise that, in most of the world, the traditional peasant is very individualistic and conservative; he imagines that if these characteristics are reactions of the farmers' conduct when confronted by the circumstances, we can modify them by acting upon them. But character traits are relatively immutable by circumstantial changes.

Foster imagines the existence of a "limited good" to characterize the traditional agriculturist. This image of the limited good is a consequence of the scarce goods that are available to him imposing a sort of solidarity before the community, which blocks his initiative or progress. This way, the image of the limited good would be imposing a restraint on the desire to change, or a subtle repression on individual attempts to accept innovations. Frasmus proposes the "chosen syndrome", the explanation of the attachment to tradition that would cause the individual to perpetuate himself in a stereotype. This is more or less marked, depending on the communication and the circle of relations that may tend to strengthen or weaken this shy and/or distrustful personality. Moscardi, after dealing with these impressive concepts, argues that the only thing we may see clearly is that the nature of the group's social character imposes a particular slant on the relations of the individual with his environment, and can, in certain cases, depending on the characteristics of those relations, show a relatively strong barrier to change. Granted the work is of an agricultural economist, who considers that solely analyzing economical factors is simplifying matters too much and will not, by themselves, give an explanation of behaviour, he supposes that what matters is how these elements interact in a decision-making process, in which a portion of risk plays a fundamental role in the barrier against change. Making use of regression models he decided to prove this hypothesis (risk), and using the information extracted from a statistical poll of the Puebla Plan, establishes a theoretical model of adoption, in which a restriction, related to a probability of obtaining a minimum subsistence income, plays a very important role, supposing it tries to reflect the risk in the farmer's decision making process.

These are his main conclusions:

a) Risk plays an important role in decisions related to the productive process.
b) The traditional farmer will respond favourably to the new technological practices, whenever they are economically advisable, if their adoption does not imply such a risk that the individual may obtain an income below the minimum subsistence requirement.
c) If the new technological practices provide an answer to the farmer's true needs as a basic economic condition, the process of transference of technology will be undertaken under more favourable conditions.

The last piece of research, presented scarcely a month ago was by Ing. Jose Antonio Avila and its title is: "Factors that may act as restrictions in the application of the recommendations of the Puebla Plan".

Without inference to the analysis of the previous works which imply that the farmer knows the recommendations and wants to follow them, and that there is no other institutional hindrance other than the risk, Avila assumes that: a) technology may be complex, b) That the insumos* do not get there in time, or in the required amounts, and c) the participant farmer is simply ignorant of the recommendations.

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* supply of money or credit

For this, he asserts behaviour models which he proves empirically through regressions and reaches the following conclusions.

1) The study suggests that a high percentage of the participants in the Puebla Plan tend to follow the recommendations which refer to the dosage and application of fertilizers; the percentage decreases concerning recommendations for the proper time for its application and reaches a minimum in respect to the density in which sowing should be done. If you consider only these three factors, only 28 percent of the participants follows all the recommendations.
2) Study suggests that the main causes of why the participant does not follow the recommendations is because he does not know them correctly. The risk, the complex technology, the insufficiency and lack of opportunity in the delivery of insumos are causes that help explain why a participant will not follow the recommendations.

These factors are found in a similar project which has been relatively more successful. The factors responsible for this situation could be generalized in the following: a) Physical factors, b) Economic factors, c) Organizational factors, d) Institutional factors, e) Cultural and Motivational factors, f) Scientific and technological factors.

It is clear that all these factors work in relation with one another, and that is why it is defined as a "system problem", and it has also been mentioned that an underdeveloped country cannot easily attack it in all its fronts; it is therefore indispensable for the limited resources of a country to be ascribed in an economical manner.

From the aforementioned it is obvious that a problem of this nature will require much research in diverse fields, that will allow the production of enough coordinated information to try to solve such a complex situation efficiently. Research to begin with should be planned with definite purposes in mind. An array of questions rise immediately. What type of research is necessary? Should it be of short or long range? Will the information allow us to ask how much will agriculture advance if it is diffused and adapted by the farmers? At what cost? How much will this process depend on new and advanced knowledge, if we know we are facing strong problems in the process of adoption of technology we have not yet overcome? This has a series of implications of every type, if we know a series of problems cannot be solved at a short range, others can, and we should try to establish an adequate balance. Given a growing population and an industrial sector that may be set back by a delay in the agricultural sector. The political leaders that wish to survive cannot spend years waiting for results, and this will have to show in the budget. On the other hand, inadequately planned measures taken at a short range, can turn into serious problems in a few years.

This implies that apparently promising options that have worked on a local scale, should be carefully analyzed. The only conclusion which we have trust in, is that credit experiments, of farmers organizations, Puebla type projects, etc., should be done initially in a small scale, and not be transplanted at a national scale until they are deeply analyzed, in order to avoid great downfalls.

In consequence, it is a fact that the transference of technology from a nation to another (and from place to place within the same nation) promises great benefits, but is risky and complicated. When you compare technology and yields of one country with another, you may conclude that a transference of technology will translate into impressive advances in the agricultural sector; nevertheless, downfall after downfall should warn us that this is not the case.

The transplant of the agricultural technology is not easy or quick, and it often unfortunately happens that the investigators of an underdeveloped country tend to follow the investigation manners of their colleagues in developed countries (to publish in some respectable Journal), thereby neglecting their nation's interests, and the local investigation consequently suffers a negative slant, due, in part, precisely to the transference. In Mexico, for example, for many years temperate zone investigation was neglected, and was only recently initiated. Of the transmission and adoption of the same, even simple processes can be complex from the receptors point of view.

In my judgement, a long and painful investigation effort in short and long term interdisciplinary investigation, should be started by each country. Larger sums of money will have to be allocated to these processes, and the country should provide to both education and agricultural investigation, the best and larger part of its human resources.

9

CONSEQUENCES OF THE "GREEN REVOLUTION"

ROBERT E. EVENSON

Eight years have passed since the introduction of the high yielding wheat and rice varieties in Asia and Africa gave rise to what has been described as a "green revolution." A great deal has been written about the promise and the failure of the revolution. Many discussions of the consequences of this new technology for employment and other resource adjustment problems have been published. It is very difficult, however, to glean from this literature a realistic estimate of the actual gains (and losses) in welfare realized as a result of these improved crop varieties over the past eight years. It is even more difficult to appraise the nature of the distribution among farmers and consumers of these gains or of losses that might have been realized in the process.

It would be too pretentious to suggest that this paper offers a complete and detailed appraisal of these issues. The paper does report, in Part I, a crude estimate of the "gains" from the improved varieties. Perhaps of more significance than the rough estimate is the framework of analysis. The green revolution is treated, not as an exogenous and miraculous event, but as a consequence of economic activity directed toward the discovery and diffusion of improved technology. This perspective provides at least some basis for projecting future gains from technology discovery and diffusion.

Part II of the paper deals with the issue of the distribution of gains and losses from technology. The focus is on analytic perspective. The basic model utilized relates the demand for factors to product demand, factor supply and technical change. The implications of the model regarding the effect of technical change on factor demand and factor prices clarifies a number of issues which are confused by many writers on the topic.

A review of data in Part III from a number of Asian countries supports the implications of the distributional model and indicates that the most serious distributional implications of green revolution type technical change ensue from the marked regional differences in its adoption.

I. THE REALIZED GAINS FROM THE HIGHER-YIELDING WHEAT AND RICE VARIETIES

We are currently experiencing a growing sense of concern (or alarm) over the prospects for expanding food production at a rate sufficient to maintain per capita levels of consumption (Baghavan,

et al, 1972, Harris, 1973). It would appear that the "panic literature" of the pre-green revolution era in the middle 1960's is making a comeback. The promise that was generated by the early experience with the green revolution has all but vanished.

Surely the rapid rate of population growth currently being experienced in most poor countries is a matter for concern. Expressions of alarm, however, contribute little to our understanding of the determinants of population growth or of food production. In retrospect, the high yielding varieties of wheat and rice have meant a great deal to the welfare of large numbers of people in several developing countries. In their absence, food consumption per capita would have been considerably lower over the past few years.

It is not difficult to build "doomsday type" models of food and population growth. Malthus's pioneering work in this field showed that one need only ignore the capacity of an economy to discover more efficient techniques of production in order to reach a "dismal" prognosis. In point of fact, virtually all economies have demonstrated a capacity to become more efficient food producers over time. We do not have Total Factor Productivity (TFP) measures for many less developed countries. The series available for the agricultural sectors of the Philippines, Taiwan, Korea, and India as well as the historical series for the United States, Israel, and a number of other countries enable some generalizations however: 1) Rates of growth in TFP tend to range from approximately one percent per year in countries which do not devote significant resources to technology discovery to upwards of four percent or more in those which do. 2) TFP series exhibit some cyclical behavior. Some of this is due to weather cycles of generally short duration, but more fundamental factors lie behind the longer cycles. 3) The contribution of the high yielding wheat and rice varieties represented a significant but certainly not a permanent increase in the rate of growth in TFP in a number of countries.

In a number of countries not otherwise pursuing an aggressive research program, the initial successes of the high yielding varieties created the false illusion that the temporarily high rates of productivity growth meant that a more permanent regime of rapid growth was underway. "Self-sufficiency" in rice or wheat production became a part of the politics of a number of countries. In fact, it is now clear that countries which had not managed to make the investments required for rapid productivity growth prior to the green revolution are not achieving it today. Indeed, the perspective emerging from studies of the determinants of productivity change in agriculture and of the discovery and diffusion of improved technology is that the green revolution was itself a manifestation of the failure of a large part of the developing world to invest in technology discovery activity.[1] Had the developing countries pursued an aggressive program to build research institutions of high scientific quality, the improved varieties would have been discovered much earlier and would not have been unusual or revolutionary. This does not mean that the process of technology discovery necessarily results in a "smooth" incremental flow of new discoveries, but it is generally the case that we do not observe dramatic technological developments in these regions of the world where research investment has been relatively high.

Consequently, when we evaluate the contribution of the particular high yielding varieties associated with the green revolution, it is important that they be treated as exceptional and non-repeat-

1) See the discussion of the green revolution by the author in a recent paper (Evenson 1974).

able discoveries. They are non-repeatable in that the major gains to be had from the reserch programs in the CYMMT and IRRI research centers have been exhausted.[2] Further gains can be expected from these research programs, but they are likely to be relatively "ordinary" in character. There is, of course, some prospect for considerable improvements in other crops.

The major prospects for further extension of gains from the green revolution discoveries does not reside with the International Centers alone, but with national research systems as well. The plant breeding and agronomic research programs in the numerous geo-climate regions of the less developed world have realized a major gain in "Knowledge capital" in the form of new genetic material from the International Centers. Many have already incorporated the new dwarf plant type material into these breeding programs. Indian plant breeders, for example, have developed "triple-dwarf" wheat hybrids and have produced new rice varieties based on the dwarf fertilizer-responsive plant type. Countries and regions lacking research capabilities have generally gained relatively little from the green revolution.

This, of course, implies that agricultural technology is not easily transferable across international boundaries or, more particularly, across regions differing significantly in soil, climate, and economic characteristics. Most informed judgment (by agriculturalists, not economists) as well as a good deal of evidence supports the contention that very little costless, or nearly costless transfer between regions takes place. A recent study by the author and a colleague, Yoav Kislev (1973) concluded that, prior to the green revolution period, virtually no direct international transfer of wheat and maize production technology took place. Furthermore, indirect transfer between countries, that is, the extent to which one country benefited indirectly from research activity in another country was virtually nil if the transferee country had not developed a research capability of its own.

The limitations to technology transfers are based on the specifity of production techniques to soil, climate and economic characteristics. A specific crop variety is superior to other varieties only under a limited range of these characteristics, and an improvement in that variety represents a real improvement only under a slightly broader range of these characteristics. This point has been missed by many observers of the green revolution. The often expressed disappointment over the slow rate of adoption of the new high yielding varieties in many countries reflects this.[3]

Any attempt to estimate the production increases due to the "green revolution" varieties must make some kind of distinction between the production increases which might be attributed to indigenous research activity in national research systems and production increases due to the "high yielding varieties" that were produced outside these national systems. The following development provides a basis for utilizing available, though limited, data for doing this.

Let the aggregate production function describing aggregate agriculture output as function of agricultural inputs and input "qualities" be:

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2) This exhaustion is borne out by the fact that relatively little improvement has been made over the initial high yielding varieties, especially of rice.

3) Some observers seem to be judging the matter on the premise that the samll set of high yielding wheat or rice varieties developed at CIMMT and IRRI are actually superior to alternative varieties on 100 percent of the wheat and rice acreage of Asia. This is simply not the case, as virtually all agricultural data would attest.

(1) $$Y = f(f_b(X_bQ_b), f_m(X_mQ_m))$$

The production function f is homogeneous of degree one, and is written as a function of two "sub-processes," a biological process, and f_b and a mechanical process, f_m. Each process is a fuction of a vector of inputs (X_bX_m) scaled into standard "quality" units by a vector (Q_bQ_m). Sadan (1970) among others, provides some evidence that the elasticity of substitution between the two sets of inputs, X_b and X_m, is relatively low even though it may be quite high for different inputs within each process. For example, labor and mechanical equipment are easily substitutable in the f_m process. Our major interest here is in identifying the relationship between output, Y, and Q_b the quality composition of the biological inputs. The utilization of plants with improved biological properties (from an economic point of view) represents a change in this quality vector.

If we make the assumption that the ratio of mechanical inputs, X_m, to land has remained unchanged since 1950 (or has changed smoothly over time in this specification) the following estimable specification of (1) is possible:

(2) $$Y_t/\bar{Y}_{50} = C(L_t/\bar{L}_{50})^{a_1}(F_t/F_{50})^{a_2}A_t^{(a_3+a_4S_t)}RA_t^{(a_5+a_6ZS_t+a_7(A_t+S_t)}$$

$$+a_8(A_t+S_t)^2)_{EXP}(a_9HYV_t+a_{10}HYV_tA_t+a_{11}(HYV_t)^2+a_{12}t$$

$Y_7/\bar{Y}_{50}$ is the ratio of wheat (rice) production in period t to mean production in the years 1949-50-51

$L_t/\bar{L}_{50}$ is the ratio of harvested acres of wheat (rice) in period t to the mean land in 1949-50-51

$F_t/\bar{F}_{50}$ is the ratio of fertilizer used on all crops (not available by crop) in period t to the mean land in 1949-51.

Note: These variables are designed to measure the contribution of X_m and X_b to production. Preferably we should have data on labor, machines and animal power. These "left-out" variables bias the land coefficient (if they are highly correlated with land) such that land "picks up" the contribution of the left-out variables.

A_t, S_t, RA_t and ZS_t are knowledge capital variables. They are constructed from research investment or activity data; e.g.:

$$A_t = \sum_{1942}^{t-5} P_t + .8P_{t-4} + .6P_{t-3} + .4P_{t-2} + .2P_{t-1}$$

The research measures are based on the number of publications (P_t) which have been screened for commodity relevance and for scientific significance by two international abstracting journals. Plant Breeding Abstracts and Biological Abstracts.

A_t is a measure of the research undertaken in agronomy and plant breeding specifically with wheat or rice.

S_t is a measure of research activity in plant physiology, phytopathology and soil-science. This work is not commodity specific and represents agriculturally related scientific research activity.

RA_t measures agronomic and plant breeding research activity in countries other than the country in question, but which are in the same geo-climate region.

ZS_t measures agriculturally related scientific research in other countries located in the same geo-climate zone.

All research variables are expressed on a per sub-region basis.

These latter three variables are designed to incorporate geogra-

phic technology transfer specifically, if somewhat crudely, into the analysis. The geo-climate regions and zones are defined as modifications of the agricultural climate classification of Papadakis [1966] and are discussed extensively in Evenson [1973]. Table 2 provides summary information for 33 major geo-climate zones grouped in 9 geo-climate zones. For purposes of this paper, geo-climate zone 1 includes most of the LDC rice production and geo-climate zones 1, 3, and 4 include the LDC wheat producing areas.

The table indicates the 1971 levels of the variables. A_t and S_t expressed on a "sub-region" basis. The A_t variable is reported for each significant crop produced in the region and for all cereals. These measures give an indication of research activity per major research "problem." As the table indicates, the relative levels of research activity in the largely developed climate zones (7, 8 and 9) have been roughly five times as great as the levels in the less developed climate zones (1, 2, 3 and 4). The disparity in research activity in the supporting sciences (S_t) is much greater. The cereal yield data shown in the table give a crude indication of economic performance by region.

HYV_t is the percentage of wheat (rice) planted to "high yielding" varieties defined by Dalrymple (1973). This variable is designed to measure the contribution of the green revolution.

Regression results for wheat and rice production in several Asian and Middle Eastern countries for the 1948 to 1971 period are presented in Table 2. These may be compared with the results of a simplistic version of the specification reported in Table 3. The Table 3 results are based on the proposition that the national research systems did not contribute to production (incidentally the two data sets differed slightly so R^2 cannot be compared. In the Table 2 regressions the knowledge capital variables contributed significantly to R^2). Note that the simplistic version bears out the expectation that as the HYV percentage increases, the increment to production decreases. In fact, for the region as a whole, the production effect decreases to zero at less than 30 percent adoption for wheat and at about 50 percent adoption for rice.

When we consider the results of Table 2 which incorporate the indigenously generated knowledge capital variables, the picture changes considerably. The key variable determining the value of HYV's is the indigenous research activity. The coefficient a_{11} is highly significant in both regressions. The negative (but highly significant) coefficients, a_9 and a_{10}, indicate that some diminishing returns to increasing the HYV percentage still hold, but the implications are less serious than the simplistic model suggests.

This diminution of the HYV contribution is, of ources, to be expected on the technology specifity grounds. The activities of indigenous research systems go a long way toward offsetting this diminution by modifying the technology. We should note here that Dalyrmple in his survey, includes as high yielding varieties, many varieties which have actually been produced by national research centers.[4]

In Table 4, I have computed the economic value of the production of wheat and rice which would not have been produced had the high yielding varieties not been developed. This computation is based on the regression results in Table 2 and is a measure of the over-

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4) See Dalrymple (1973). Mr. Dalrymple has been kind enough to provide me with unpublished data on high yielding varieties for 1971-72 and 1972-73. He indicates that he is now attempting a distinction between the purely "international" varieties and the joint product of national and international research effects.

Table 1 GEO-CLIMATE REGION

Region #	Publications (1942-70) per Sub-Region				
	Wheat	Barley	Maize	Sorghum	Rice
1. Tropical Zone					
1.1 Humid Equatorial	--	--	30.2	11.6	111.8
1.2 Humid Tropical	1.5	.2	15.1	2.1	121.7
1.3 Dry Equatorial	--	--	4.7	1.1	22.5
1.4 Hot Equatorial	8.4	--	19.3	13.6	224.5
1.5 Semi-Arid Equatorial	.0	--	4.1	32.2	8.6
1.7 Humid Tierra	20.4	20.4	30.6	26.0	20.8
1.8 Dry Tierra	--	--	42.4	--	18.1
1.9 Cool Winter Tropical	--	--	18.5	87.4	353.1
2. Tierra Fria Zone					
2.1 Tropical Highlands	8.0	6.7	132.9	28.2	--
3. Desert Zone					
3.1 Hot Tropical	.0	--	2.0	--	4.5
3.2 Hot Subtropical	20.9	11.8	--	--	6.7
3.7 Continental	1.4	1.6	.0	.0	93.5
4. Subtropical Zone					
4.1 Humid	30.4	4.7	51.6	1.6	63.0
4.2 Monsoon	116.6	128.1	69.7	144.9	52.0
4.3 Hot	105.7	46.7	47.6	156.8	6.6
4.4 Semi-Arid	--	--	10.0	5.0	--
5. Pampean Zone					
5.1 Pampean	99.5	99.0	168.4	36.6	--
6. Mediterranean Zone					
6.1 Subtropical	72.9	71.3	33.5	11.7	104.9
6.2 Marine	14.0	2.2	34.4	12.0	.0
6.5 Temperate	77.3	18.9	45.5	4.0	23.5
6.7 Continental	67.0	27.7	133.4	8.3	1.6
6.8 Subtrop.Semi-Arid	46.9	22.8	21.3	6.0	--
6.9 Contin.Semi-Arid	4.6	3.0	9.0	1.0	--
7. Marine Zone					
7.1 Warm	11.5	5.4	--	--	--
7.2 Cool	78.9	236.3	92.9	--	--
7.6 Cool Temperate	97.1	145.8	158.9	20.3	--
7.7 Cold Temperate	90.6	144.8	187.9	--	--
8. Humid Continental Zone					
8.1 Warm	152.4	151.2	460.5	92.2	417.0
8.2 Semi-Warm	164.3	124.1	703.0	283.5	622.3
8.3 Cold	52.0	17.0	--	--	--
9. Steppe Zone					
9.2 Semi-Warm	606.5	346.6	818.6	304.2	24.7
9.3 Cold	636.4	348.5	111.9	12.0	--
9.4 Temperate	38.2	35.5	--	--	--

Notes: Publications data from Evenson, R.E. and Kislev, Y. [1971].
Sub-regions are defined as n(1-d) + d where n is the number of individual the crop in country i.
The term d = 0, when all countries in the region have the same acreage, Cereal grain yields are computed by simply totaling cereal production by country, international prices per Kg are approximately the same for

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Cer. Pub. per Sub-Region A_{71}	Basic/Crop pub/ Pub. S_{71}/A_{71}	Adjusted Number of Sub-Regions	LDC Share	Cereal Grain Yields 1950-51 (Kg/ha)	1966-67 (Kg/ha)	Ratio
48.3	.90	15.91	1.00	11.00	13.79	1.253
51.6	1.06	5.00	.86	11.92	14.33	1.20
28.1	.32	4.06	1.00	16.98	24.62	1.45
8.2	1.53	10.22	.95	10.61	14.53	1.37
68.7	.96	6.35	1.00	10.57	13.58	1.26
8.6	.65	16.19	1.00	8.46	10.69	1.26
24.1	.85	2.06	1.00	12.38	12.91	1.04
52.8	.50	5.58	.86	14.49	10.11	.70
144.9	1.00			10.39	13.77	1.33
52.1	.62	8.72	1.00	7.93	12.84	1.619
52.1	.62			7.93	12.84	1.619
15.6	2.69	3.00	1.00	9.22	12.05	1.307
2.3	.22	16.94	1.00	28.28	31.86	1.13
15.8	.76	4.00	.60	8.99	11.80	1.31
24.5	6.26			9.98	11.83	1.19
54.9	1.18	9.22	.75	6.83	9.01	1.320
28.4	1.20	6.91	.66	12.50	15.65	1.25
102.7	1.31	6.05	1.00	6.41	8.16	1.27
68.7	.99	2.00	1.00	5.27	7.41	1.42
7.5	.80			14.21	17.93	1.26
97.3	1.23	4.53	.20	13.61	16.73	1.229
97.3	1.23			13.61	16.73	1.23
39.6	1.95	18.68	.45	10.14	13.03	1.284
55.4	2.59	7.24	.25	10.38	13.10	1.26
16.8	.80	11.27	.17	9.20	13.32	1.45
37.4	1.90	19.68	.30	11.93	15.86	1.33
47.5	1.41	14.26	.50	10.79	14.48	1.34
26.7	1.68	4.61	.66	8.64	7.75	1.13
5.8	.20			6.16	6.48	1.05
120.1	2.02	2.00	.00	17.01	28.13	1.654
4.4	2.00	6.81	.00	25.13	35.48	1.41
136.1	3.10	21.71	.03	22.12	34.82	1.57
120.3	1.75	8.00	.00	18.44	28.86	1.57
133.9	1.46			9.62	20.79	2.16
256.2	2.79	7.62	.00	19.61	34.02	1.735
254.3	4.60	12.16	.00	24.43	42.54	1.74
291.5	1.50	2.00	.00	18.77	33.55	1.79
34.5	.63			7.98	11.90	1.49
357.9	1.35	12.92	.00	11.57	18.26	1.578
450.3	1.10	7.28	.00	12.29	21.14	1.68
382.3	1.75	4.34	.00	10.11	14.82	1.47
36.9	1.96			11.85	17.36	1.47

countries in the region, and $d = \sum_{i=1}^{n} A_i - \bar{A} / (2A_i - 2)\bar{A}$. A_i is the acreage of

approaches 1 as acreage in the region is concentrated in one country.

of the different grains without price weighting. While prices vary considerably

all cereals.

Table 2 REGRESSION ANALYSIS: WHEAT AND RICE PRODUCTION ASIAN-MIDDLE EASTERN COUNTRIES, 1948-71

Independent Variables	Wheat Production 10 Asian-Middle Eastern Countries 240 observations	Rice Production 12 Asian Countries 120 observations
LN (Land) (a_1)	1.0050 (63.5)	1.0217 (107.4)
LN (Fert) (a_2)	.0693 (4.05)	.0409 (2.91)
LN (A) (a_3)	.0112 (1.10)	-.0144 (2.54)
LN (A)* S (a_4)	.00067 (4.36)	.00024 (2.00)
LN (RA) (a_5)	.1656 (6.16)	-.0179 (2.08)
LN (RA)* ZS (a_6)	.000046 (2.29)	.000010 (1.52)
LN (RA)* (A+S) (a_7)	-.00068 (2.39)	.00002 (.18)
LN (RA)*$(X+S)^2$ ($_8$)	-00000074 (4.35)	-.00000018 (6.00)
HYV (a_9)	-.0026 (.61)	-.0097 (1.96)
HYV^2 (a_{10})	-.000071 (.86)	-.000018 (.27)
HYV* A (a_{11})	.0009 (3.63)	.000039 (5.70)
LN (Time) (a_{12})	.296 (2.33)	-.0181 (3.63)
Constant	-2.47	1.22
R^2 (Adj.)	.987	.998

Regressions weighted by area and estimated citilizing Nelove-Baelestra techniques "t" ratios in parentheses.

Table 3 REGRESSION ANALYSIS: HIGH YIELDING VARIETIES Contributions; Simplistic Model

Independent Variables	Wheat Production (13 Asian-Middle Eastern Countries 1948-71) 307 observations	Rice Production (12 Asian-Middle Eastern Countries 1948-71) 282 observations
LN (Land)	.9836 (.0030)	1.0374 (.0030)
LN (fert)	.0411 (.0058)	.0477 (.0021)
HYV	.430 (.0018)	.0052 (.0010)
$(HYV)^2$	-.00085 (.00004)	-.00005 (.00002)
Constant	.1758	-.2208
R^2	.9859	.9965

Notes: Dependent variable LN (Production). Regressions weighted by area harvested. Standard errors in parentheses. Production, land, and fertilizer scaled relative to average levels in 1948-49-50.
HYV is the percent of the acreage of wheat or rice planted to "high Yielding" varieties as defined by Dalyrmple [1973].

Table 4 ESTIMATION OF ECONOMIC GAINS ASSOCIATED WITH THE DEVELOPMENT OF HIGH YIELDING WHEAT AND RICE VARIETIES IN ASIAN AND MIDDLE EASTERN COUNTRIES

	1965-6	1966-7	1967-8	1968-9	1969-70	1970-1	1971-2	1972-3
Wheat								
Aggregate Adoption Level	.001	1.5	9.7	18.9	20.5	24.0	28.3	34.1
Production Increase	.01	1.5	10.9	18.3	19.3	22.1	24.0	28.2
Economic Value at $75/m. ton in millions U.S. $	.4	58	436	732	772	884	960	1128
Rice								
Aggregate Adoption Level	.001	1.1	3.4	6.0	9.9	13.1	17.1	20.9
Estimated Production increase	.01	1.0	3.3	5.5	9.6	12.7	16.5	20.7
Economic Value at $100/m.ton in millions U.S. $	1.3	148	463	784	1365	1798	2329	2933

Note: Aggregate Adoption Level computed from data provided by Dalrymple (1973). Percent production increase computed from regression coefficients in Table 2.

all "gains" of the green revolution. Note, however, that it is not a measure of the contribution of the International Centers. In Vact, if these results are to be taken strictly, the green revolution would not have occurred, if these countries had not had an indigenous research capability.

The implication of the Table 2 regressions are that if no further indigenous research is undertaknen, the marginal contribution of further adoption of high yielding wheat varieties will reach zero at about the 50 percent adoption level (this is because of the negative a_9 and a_{10} coefficients). The counterpart figure for rice is higher, in fact close to 100 percent. In both cases, further research activity in the national research systems will significantly extend the impact of the green revolution. The gains realized by 1973 are very impressive, on the order to 28 percent for wheat and 20 percent for rice according to these data.

II. DISTRIBUTION OF THE GAINS AND LOSSES

As the previous section shows, the green revolution was not costless. The gains have been realized in significant degree according to the willingness of countries to invest in research, and to a lesser extent in extension.[5] Individual producers, likewise do not find the new technology to be costless to adopt. A considerable amount of effort must be devoted to learning, experimenting and evaluation by farmers. Setting aside these costs for the moment, however, we wish to turn to the distributional effects of the realized gains.

At least four dimensions to the distributional question are important here:

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5) For a comparison of the effect of extension and research as sources of real productivity gains in India see Mohan, R. and Evenson, R. (1974).

1. How have gains been distributed between consumers of wheat and rice and producers of wheat and rice?
2. How have producer gains (and losses) been distributed between factors of production, land, labor and other assets?
3. How have producer gains been distributed by scale of farm and by tenancy?
4. How have producer (and consumer) gains been distributed regionally within countries?

We have some data from farm surveys as well as some data on factor prices with which to begin to approach these questions. It is, however, very important to maintain an analytic perspective in this matter. To that end we turn now to a discussion of a model which relates technical change to factor and product markets. We will be particularly interested in the effect of technology on the demand for labor.

The Technical Change and Factor Markets: A Simple Two Factor Approach

We start with a simple aggregate production fuction for agricultural goods:

$$Y = T\ F(L,K)$$

where Y is aggregate output, L is labor, for the time being assumed to be homogeneous, and K is the aggregate of non-labor factors of production. T is an index of productivity. Shifts in T are neutral in that the ratio of marginal products of L and K are unchanged. Production is subject to constant returns to scale (a reasonable statement for most less developed countries) hence;

$$f = Lf_\ell + Kf_k, \text{ where } f_\ell = \frac{\partial f}{\partial L} \text{ and } f_k = \frac{\partial f}{\partial K}. \quad \text{Also, } \sigma = \frac{f_k f_\ell}{f\ f_{\ell k}}$$

Now we first suppose that the demand for Y is perfectly elastic at $P_y = 1$, and that the supply of K is also perfectly elastic. The marginal conditions are:

$$4)\ P_\ell = Tf_\ell$$
$$5)\ P_k = Tf_k$$

Solving for equilibrium, we obtain:

$$6)\ \frac{EP_\ell}{ET} = \frac{\partial P_\ell}{\partial T}\ \frac{T}{P_\ell} = \frac{1}{S_\ell} = \frac{EL}{ET}.$$

That is, the elasticity of the price of (and demand for) labor with respect to a change in technology is simply the reciprocal of the share of labor in total costs. This result is straightforward. A one percent increase in productivity has the initial effect of reducing average costs by one percent. To reattain equilibrium, producers will increase output and will bid up the price of labor until average costs rise by one percent. Since the price of non-labor inputs will remain constant and product price will not fall, this requires an increase of $\frac{1}{S_\ell}$ percent in the price of labor.

This case is the most favorable one for labor in the presence of productivity change. It is not as unrealistic as it might seem for many situations. A country importing substantial food grains faces a very elastic demand for agricultural products. Likewise, imported inputs such as tractors and fertilizers may have very elastic supply functions. Of course land is inelastic in supply, but irrigated land may not be. In the case of a small region in a large country (such as Punjab-Haryana in India) the initial effects of productivity gains may not be too badly approximated by this simple

model. If the marginal product of labor is less than the wage rate by some factor $d < 1$, the elasticity is lower by this factor, d.

It is easy to extend the model to allow the supply elasticities of K and L to vary. The expression for the elasticity then becomes:

$$7) \quad \frac{EP_\ell}{ET} = \frac{\sigma + \varepsilon_k}{\sigma + S_k \varepsilon_L + S_\ell \varepsilon_\ell} = \frac{1}{1 + \frac{S_k(\varepsilon_\ell - \varepsilon_k)}{\sigma + \varepsilon_k}}$$

where ε_k, ε_ℓ are the supply elasticities of L and K. How we see that the elasticity of substitution enters the expression (unless the supply elasticities are equal in which case $EP_\ell/ET = 1$). In the case of the region of India affected by the green revolution (Punjab-Haryana-Gujurat-U.P.) we would expect ε_k to be less than ε_ℓ especially in the long run. This would imply that EP_ℓ/ET would be less than one and that K would increase in price more than L, in response to productivity change. Labor can migrate into the regions and would have an incentive to do so. In fact with a low short run elasticity of labor supply and a higher long-run elasticity, one would expect wages to decline after some point.

The implications of this model for productivity gains in particular regions is of considerable significance. To see this somewhat more clearly we need to relax the assumption of a perfectly elastic demand. Let the demand function for agricultural products be:

$$8) \quad Y = \phi(P); \; \eta = \frac{P}{Y} \cdot \frac{dY}{dP} < C$$

The equilibrium conditions are:

$$9) \quad \phi(P) = T\,F(L,K)$$

$$10) \quad P_\ell = PTf_\ell$$

$$11) \quad P_k = PTf_k$$

Constraining factor market equilibrium (that is, staying on the factor supply curves we have:

$$12) \quad \frac{EP_\ell}{ET} = \frac{-(\eta + 1)(\sigma + \varepsilon_k)}{\Delta}$$

where $\Delta = -\eta\sigma - \eta(S_\ell\varepsilon_k + S_k\varepsilon_\ell) + \varepsilon_k\varepsilon_\ell + \sigma(S_\ell\varepsilon_\ell + S_k\varepsilon_k)$ and Δ is positive, since $(-\eta)$ is positive. Also

$$13) \quad \frac{EP_\ell}{ET} - \frac{EP_k}{ET} = \frac{-(\eta + 1)(\varepsilon_k - \varepsilon_\ell)}{\Delta}$$

We now see that the elasticity of demand for labor with respect to technical change can indeed be negative. Its sign depends on the term $-(\eta + 1)$, and we can see that if the demand for agricultural products is inelastic, the price of labor will fall in response to a gain in productivity, (the fall will be greater the lower is σ and the lower is ε_ℓ.

We are now in a position to say something about the distribution of gains from technical change. A 10 percent change in T will lower average costs to producers by 10 percent. The term, $-(\eta+1)$ the elasticity of total revenue, tells us by how much the prices to consumers will fall as the supply curve shifts by 10 percent. Prices will fall by more than 10 percent and the consumer will capture more than 100 percent of the gains, if the elasticity of demand is less than one. Producers will respond by adjusting the amount of

L and K utilized such that average costs will be equal to prices. However, if the supply of labor is relatively inelastic, labor prices will be bid down and labor will bear the brunt of the resource adjustment required.

This is the classic "farm problem" case that has been a major issue in the United States where the aggregate price elasticity of demand is generally regarded to be low (-.2 to -.4). It is very unlikely that this has happened in Asia as a consequence of the green revolution, however. The gains have been concentrated in wheat and rice production as opposed to affecting all food products. Hence price elasticities are relatively high. Furthermore, many of the countries in question are significant importers or exporters of these commodities. Again this means that a large expansion in production in one is not likely to result in a large decline in prices. On the other hand, the realization of gains by all of the major rice producing countries in Asia is quite likely to lead to significant price declines.

A Simple Dynamic Extension of the Model

We now extend the model by introducing time rates of change. In doing so, we acknowledge that we are sacrificing some realism by introducing smoothness in productivity change and supply and demand function shifts. The real world does not change very smoothly. This can be minimized by applying the model to relatively short periods of time. We gain from the extension, in that we can integrate population change and other types of shifts into the analysis. Let:

14) $Y = \phi(P,t)$; $\eta = \frac{\partial \phi}{\partial p} \cdot \frac{P}{Y}$; $\frac{\partial \phi}{\partial t} / \phi = \dot{D}$, be the demand function for agricultural products.

15) $Y = T\,F(L,K)$; $\frac{\partial T}{\partial t} / T = \dot{T}$, be the production function, and,

16) $L = g(P_\ell, t)$; $\varepsilon_\ell = \frac{\partial g}{\partial P_\ell} \frac{P_\ell}{L}$; $\frac{\partial g}{\partial t} / L = \dot{L}^*$,

17) $K = h(P_k,t)$; $\varepsilon_k = \frac{\partial h}{\partial P_k} \cdot \frac{P_k}{K}$; $\frac{\partial h}{\partial t} / K = \dot{K}^*$, be the supply functions of labor and non labor inputs. Differentiating with respect to time and solving for $\dot{P}_\ell = \frac{\partial P_\ell}{\partial t} / P_\ell$ we obtain:

18) $\dot{P}_\ell = \frac{1}{\Delta}[(\sigma + \varepsilon_k)(\dot{D} - (\eta + 1)\dot{T}) - S_k(\sigma + \eta)\dot{K}^* - (S_\ell\sigma - S_k\eta + \varepsilon_k)\dot{L}^*]$

19) $\dot{P}_k = \frac{1}{\Delta}[(\sigma+\varepsilon_\ell)(\dot{D} - (\eta + 1)\dot{T}) - S_\ell(\sigma + \eta)\dot{L}^* - (S_k\sigma - S_\ell+\varepsilon_\ell)\dot{K}^*]$

20) $\dot{L} = \dot{L}^* + \varepsilon_\ell\dot{P}_\ell$

21) $\dot{K} = \dot{K}^* + \varepsilon_k\dot{P}_k$

22) $\dot{Y} = S_\ell\dot{L} + S_k\dot{K} + \dot{T}$

23) $\dot{P} = S_\ell\dot{P}_\ell + S_k\dot{P}_k - \dot{T}$

Expressions (18) through (21) provide us with a basis for analyzing the effect of technical change on the demand for both labor and non-labor inputs. They also enable an analysis of the effects of

exogenous shifts in the supply of labor, $\dot{L}^*$, or non-labor inputs, $\dot{K}^*$ on the demand for factors. (Equations (22) and (23) define T). Perhaps the point of most interest is that the effect of neutral technical change depends, as before, on demand factors only. The term $(\dot{D} - (\eta+1)\dot{T})$ shows that the sign of $(\eta+1)$ will determine the direction of the effect of more rapid technical change. It also shows us that demand growth, D, from population and income growth will have a positive effect on the demand for factors even if demand is inelastic.

The effect of an exogenous shift in the supply of labor, because of population growth or because of an increased demand for labor in the non-agricultural sector, is determined by the $\dot{L}^*$ term. Inspection will show that it has a negative sign in (18). A rightward shift in the supply function of labor lowers labor prices. An exogenous rightward shift in the supply of non-labor inputs, $\dot{K}^*$ (as, for example, through a subsidy on credit or a subsidized machinery price) will not automatically tend to decrease the demand for labor. The sign of this effect is determined by, $(\sigma + \eta)$, a result familiar to students of factors demand. When the elasticity of substitution is high and the aggregate price elasticity of demand low, a subsidy to machinery will reduce the demand for labor.[6]

Non-Neutral Technical Change

We now modify the model to examine the effects of non-neutral technical change. Let the production function be:

26) $Y = F(\hat{L},\hat{K})$ where

27) $\hat{L} = T_\ell L;\ \dot{T}_\ell = \dfrac{\partial T_\ell}{\partial t}\Big/ T_\ell$

28) $\hat{K} = T_K K;\ \dot{T}_k = \dfrac{\partial T_k}{\partial T}\Big/ T_k$

T_ℓ and T_k are factor "augmentation" indexes. The solution for $\dot{P}_\ell$ is now:

29) $$\dot{P}_\ell = \frac{1}{\Delta}\left[(\sigma + \varepsilon_k)(\dot{D} - (\eta + 1)(S_\ell \dot{T}_\ell + S_k \dot{T}_k) - S_k(\eta - \varepsilon_K)(1 - \sigma)\right.$$
$$\left.(\dot{T}_k - \dot{T}_\ell) - S_k(\sigma + \eta)(\dot{K}^* - \dot{L}^*) - (\sigma + \varepsilon_k)\dot{L}^*\right]$$

---

6) When $\dot{D} = \dot{T} = \dot{K}^* = 0$ and when $\varepsilon_k \to \infty$, we can solve for:

22) $$\frac{\dot{L}}{\dot{P}_\ell} = \frac{E_\ell}{EP_\ell} = -S_k\sigma + S_\ell\eta$$

23) $$\frac{\dot{L}}{\dot{P}_k} = \frac{E_\ell}{EP_k} = S_k(\sigma + \eta)$$

These are the standard R.G.D. Allen [19] results. The importance of σ and η in factor demand is readily apparent here. In both expressions a low σ works to the benefit of labor as it makes the own price elasticity lower and the elasticity of demand with respect to a negative change in the price of non-labor inputs is more likely to be positive.

The direct effect of technical change on the demand for labor differs from the previous result only in that the technical change term is a weighted average of the augmentation indexes. An indirect effect is possible through the second term which shows the effect of non neutral change on factor ratios. We note that it is unimportant if $\sigma = 1$. If $\sigma > 1$, relative capital augmenting change, ($\hat{T}_k > \hat{T}_\ell$), will have an indirect negative effect on the demand for labor. The third term shows the effect of an exogenously changing factor share. The implications for $\hat{K}^*$ and $\hat{L}^*$ are as before.

The importance of this effect in connection with the green revolution remains quite debatable. The new wheat and rice varieties have probably been fertilizer and water augmenting. They have probably also been machine augmenting to a lesser degree, although in certain soils, especially for wheat production, mechanical power has been augmented since it has a comparative advantage for deep plowing over animal power. It has also been mechanical power augmenting in cases where multiple cropping has been made more economic. It would be a pretty reasonable presumption that in most of the green revolution areas, $\sigma > 1$ and $\hat{T}_k > \hat{T}_\ell$.

Regional Issues

One of the purposes of the discussion of the green revolution in part I of this paper was to emphasize the regional nature of the realized gains. This is especially critical within large countries where a national market for the commodity is functioning, and where producers in only certain regions have realized green revolution gains. The specificity of technology superiority to soil and climate factors is almost certain to produce some uneven regional realization of cost reduction by producers. This tendency is accentuated by the low levels and uneven distribution of technology discovery activity in most LDCs. (see Table 1)

Consider a country with 2 regions, A and B. It produces rice in both regions and rice is marketed and transported from both regions to the major urban areas. Suppose first that demand is highly elastic and that region A realizes a 10 percent increase in production from new varieties. The economic effects of this will depend on the mobility of factors. If labor were perfectly mobile, as producers bid up the wages in region A, workers would move from B to A. The wage increase would be the same in both sectors and determined by expression (7)

The price of the immobile factor would rise in region A and fall in region B in such a way as to equate average costs for both regions. Labor is, of course, not a perfectly mobile factor. If it were the case that no factors were mobile between the 2 regions, the price of factors in region B would not change while the prices of factors in region A will increase in such a way as to equate average costs. Essentially, this means that the previous analysis could be applied to region A.

The real world is one where, aggregative demand is not perfectly elastic and where factors except for land are partially mobile. Labor is much less mobile between regions than fertilizer and machines which are close to being perfectly mobile. The fact that as quantity supplied increases, price declines means now that productivity change in region A can reduce factor incomes in region B according to the degree of immobility of the factors. This is the essence of the "Appalachia" model in which one region can be seriously damaged by productivity gains in another region. As we will note later, this is an important phenomena in India.

Table 5 LABOR INPUT PER HECTARE: HIGH YIELDING TECHNOLOGY VS TRADITIONAL TECHNOLOGY. INDEX MAN HOURS PER HECTARE BY OPERATION. HIGH YIELDING TECHNOLOGY RELATIVE TO TRADITIONAL TECHNOLOGY

	Wheat: India 1967-68	Wheat: Pakistan 1969-70	Bajra: India 1967-68	Rice: Philippines 1968	Rice: Bangladesh 1967
Operating Preparation	131	155	92	82	59
Sowing Transplanting	183		167	100	115
Weeding			112	183	309
Harvesting	152	143			134
Thrashing-Winnowing	178	145	139	120	185
All Operations	158	149	125	112	148
All Operations (per Ton)	86			81	

Wheat: India 12 Irrigated Farms Aligarh Dist. U.P. (Dixit and Singh. 1970)
Wheat: Pakistan - 143 Unirrigated Farms: Hazard Dist. (Rochin, 1971)
Bajra: India - 74 Unirrigated Farms: Kaira Dist. (Desai and Mohan, 1970)
Rice: Philippines - 147 Farms: Central Luzon and Zaguna (Barker and Mangahas 1971)
Rice: Bangladesh - 140 Plots: Camilla District (Hozue, 1968)

III. A BRIEF SUMMARY OF AVAILABLE DATA

The model discussed in the previous section identified two key parameters, the price elasticity of demand and the elasticity of substitution, as determinants of the distribution of the ains from the high yielding technology. Unfortunately, we do not have reliable estimates of these parameters. Instead we are forced to rely on data which can only indirectly provide answers to the distributional questions posed.[7]

Table 5 provides a summary of "employment" data. The several studies summarized show a pretty consistent pattern. Employment of man years per hectare has increased significantly as a result of HYV technology, employment per unit of output has decreased. These data do not tell us what has happened to aggregate employment directly. We do not know specifically what has happened to total hectares of crops produced or of the effects of the shift from other crops to HYV crops. We also do not know how demand effects have affected farm behavior. To the degree that the farms sampled in these studies have responded to these market effects, however, these data provide strong evidence that the HYV technology has not been heavily

7) An estimate of the elasticity of substitution between labor and mechanical inputs of 1.44 was derived for Indian data (Evenson, 1973). This is a relatively high elasticity and suggest that biased technical change will have an employment effect.

biased towards non-labor inputs and that aggregate demand has been elastic.

A thorough study of commodity price data would be required to determine the actual extent to which consumers share in the gains from HYV technology. We will not attempt it here except to note that the prices of wheat and rice in Asia did fall in real terms during the late 1960's. Government policies regarding imports, exports and the provision of price supports have to be taken into account in a thorough analysis. In the long run, the price on average cost consequences of HYV technology will show up in the form of real price declines as they have in Mexico.

Dalrymple and Jones (1973) have analyzed the Mexican experience in wheat production is of great importance in this regard. Unfortunately, the scope of this paper has not included a thorough treatment. They estimate that over the period 1950 to 1971, average production costs for wheat declined to approximately one half the 1950 level in real terms. They show also that prices received by farmers and prices paid by urban consumers have also declined by approximately the same amount. Thus, the Mexican experience bears out the proposition that over the long run, the great bulk of the productivity gains will be distributed to consumers.[8]

Producer incomes and factor payments are affected, of course, as we have noted earlier. Before turning to the wage and income evidence, however, we will discuss the issue of scale and tenancy as determinants of producer shares in these gains. The "labor surplus" literature of a few years ago has left the unfortunate legacy of a predisposition toward the belief that the small non-commercial farm household is much less capable of rational discussion making than the larger farm.

It is certainly very plausible that small farms may be injured, if they are slow to adopt the new technology. On the other hand, small farms are not necessarily inefficient. It is difficult to make generalizations on this score, but a considerable number of production studies have concluded that "economies of scale" do not exist.[9]

We cannot explore the full set of such studies here. Table 7 provides some evidence of this issue period from a sample of 54 farms over a 9 year period in the Punjab in India. These data show that small farms tend to use more fertilizer and seed than the larger farms and do not show a tendency to lag behind the larger farms in terms of adoption of HYV production practices. We do not wish to generalize from this set of data. There are good economic reasons for a lag in the adoption process by small farmers. They have a lower incentive to experiment and to search for information. We have very little evidence, however, that they experience a significant lag in adopting new technology.

We turn finally to wage and income data which might give some indication of distribution of producer gains among factors and of regional distributional effects. Again we turn to the India data reported in Table 8. Here we have a measure of wage rate changes

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8) The U.S. experience in this regard is similar. At times more than one hundred percent of the gains have been distributed to the consumer. This sharing of the gains in the short run is largely determined by relative rates of growth in demand for food and in the productivity of food production. In the long run, of course, factor mobility is the major determinant.

9) See Saini (1971 and Evenson (1972) for a survey of these studies for India.

Table 7 PUNJAB INDIVIDUAL COST HOLDINGS DATA (1961-1969)
EXPENDITURE DATA ON INDIVIDUAL FARMS

	1969	1968	1967	1966	1965	1964	1963	1962	1961
Expend per acre SEED (Rs.)									
Large	42.0	38.3	33.9	24.9	22.6	23.1	14.9	17.5	14.9
Medium	52.4	33.5	34.6	21.8	21.5	18.7	13.9	13.4	14.7
Small	92.3	85.1	70.6	48.1	71.0	37.0	23.5	23.4	14.1
Expend per acre FERTILIZER (Rs.)									
Large	84.7	64.5	40.8	27.9	25.1	30.1	16.3	15.8	12.7
Medium	90.7	77.4	60.5	36.9	27.9	21.7	11.7	19.0	14.5
Small	112.5	65.7	44.7	40.2	61.8	37.4	26.6	22.9	24.2
Expend per acre WELLS & IRR (Rs.)									
Large	38.5	18.0	9.1	9.2	9.3	8.8	7.4	6.6	2.6
Medium	49.1	30.8	34.7	15.4	13.8	17.3	10.9	13.4	16.3
Small	59.9	35.4	30.0	14.4	17.3	25.9	31.8	35.3	23.1
VALUE OF OUTPUT per acre (irr)									
Large	1095.1	913.7	716.7	515.1	443.8	504.3	353.0	410.9	438.4
Medium	1020.8	1051.3	947.4	535.3	484.1	400.4	351.6	292.3	345.6
Small	976.7	1136.7	833.4	521.2	470.6	507.5	452.5	345.3	367.8

Source: Board of Economic Inquiry, Punjab, Farm Accounts in the Punjab, Publication No.117, 1969-1971, Chandegarh.

for rural laborers for several Indian states. The table also reports a computed total factor productivity index level for these agricultural states.

Two points bear mention: First, wage rates have changed as a consequence of the green revolution. This is most readily seen in the data for the States of Punjab and Haryna after 1966. These states are the locus of the HYV wheat area in India. The second point is that rural wages in some of the states have fallen in real terms. It is easy to overstate the implications that appear in the data in Table 8. A degree of caution is called for in view of measurement problems. Nevertheless these data are quite consistent with the implications of the uneven regional distribution of productivity change.

This sketchy discussion has not done justice to the many studies which are relevant and pertinent. A more thorough review should be undertaken. The data does suggest that some sharing of the gains (and these have been major gains) between consumers and producers has taken place, but that producers may have captured a larger share than has been the case in Mexico and other countries with similar experiences.

Producer gains have probably been distributed in favor of the holders of immobile assets. We do not have good data on land prices, but sketchy information suggest that in North India, land prices may have more than doubled between 1966 and 1972 and real wages rose by 40 percent. Returns to managerial skills have probably risen by a factor intermediate between these two estimates. Many families in this region have probably realized a doubling in total family income.

This distributional picture looks very different when regional disparities are considered. In those parts of India (and other countries as well) where productivity change has not been realized (and this is at least partially the result of research investment decisions by government), real producer losses have been sustained.

Table 8 WAGES IN INDIAN AGRICULTURE: SELECTED STATES 1957-1971

	Current Daily Wages (Rs.)				Indexes of "Real" Wages		Indexes of Total Factor Productivity	
	1957	1961	1966	1971	1966	1971	1966	1971
					(1961=100)		(1961=100)	
Andra Pradesh								
Carpenters		2.57	3.08	4.35	92.6	98.8		
Field Laborers	.87	1.26	1.79	2.62	110.3	121.4	98	99
Bihar								
Carpenters		2.84	3.71	4.34	78.9	74.0		
Field Laborers	.91	1.20	1.66	1.99	83.3	80.0	109	149
Gujurat								
Carpenters		4.42	5.38	7.71	90.1	100.9		
Field Laborers	.87	1.62	1.75	3.22	80.3	114.8	101	149
Harayana								
Carpenters		4.51	5.59	9.83	89.8	112.4		
Field Laborers	2.01	2.52	3.34	6.55	96.0	134.1	105	160
Maharastra								
Carpenters		3.22	4.74	6.70	97.5	108.4		
Field Laborers	.87	1.33	2.07	2.99	103.0	116.5	101	97
Mysore								
Carpenters		2.44	3.01	3.94	78.7	85.7		
Field Laborers	.84	1.57	2.11	2.62	85.4	88.6	90	108
Punjab								
Carpenters		4.46	6.09	12.11	98.9	139.2		
Field Laborers	2.01	2.40	3.70	6.49	111.7	139.6	105	149
Tamil Nadu								
Carpenters		2.46	3.66	4.98	100.0	116.3		
Field Laborers	.84	1.18	2.05	2.41	116.1	117.8	94	102
Uttar Pradesh								
Carpenters		2.69	3.77	5.64	84.8	114.5		
Field Laborers	.92	1.31	1.73	2.59	80.2	107.6	102	118
West Bengal								
Field Laborers	1.43	1.80	2.49	3.05	91.7	82.2	100	105

Source: R.E. Evenson (1972)
"Real" wages deflated by consumer price index for rural laborers by State.

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10

THE DIFFUSION OF TECHNOLOGY IN MANUFACTURING: THE DEVELOPMENT OF SKILLS

Noboru Tabe

INTRODUCTION

Technology transfer mechanisms and the flows of scientific and technological cultures in the developing countries have acquired new dimensions in this development decade. Where improvements in indigenous technology become crippled, technology inflows through effective transfer and the institution-building process can enable the developing economies to improve its own structural basis by remodelling the society to be receptive to new technology.

New technology imported from abroad could not be fully utilised for the purpose intended unless the country has the human ability to absorb, to refine, and to apply them. Our experience in the past decades, however, seems to exemplify the fact that the rapid process of industrialization often generated a gap between the high level of technology and the organization and human ability to effectively use the technology. It is also this gap which has hindered the satisfactory utilization of the valuable techniques imported and which has lessened the effect of technological progress.

The importance of this issue concerning the development and utilization of skills has grown with the widening gap between the indigenous techniques and those of foreign countries. For this reason, we may say that the conditions necessary for effective transfer of technology are not fully mature unless institution-building mechanisms conducive to technological progress and to development of skills are simultaneously established.

In retrospect, our experience has demonstrated that technology inflows, be it public or private, have not in may cases fully succeeded in generating forces in the developing countries in such a way as to make for economically viable and technically adaptable infrastructures. The reason for this may be that the critical element of scarce resources in the developing countries does not lie in factor inputs alone but on institution building measures to effect the efficient use of existing resources in the society. It is intended that if the present pattern of technology inflows continues, the possibility of reaching the point of diminishing returns may not be far off. Social cost may outweigh the economic effect, i.e., the gap between those who benefit from the adoption of new technology and those who are not able to adopt it is likely to widen, and the resulting social tension makes the process of technological development slower or even an abortive attempt. This trend (against which corrective measures have to be taken) is

prompted by a lopsided development in technology where linkage between pure scientific basic research and adaptive research is very poor and resources are largely concentrated in the former.

This paper is divided into two parts based on case studies of training projects in India and discusses, (1) factors affecting institution-building mechanism in fish processing technology, and (2) role function of foreign experts in the development of skills.

PART I CASE STUDY: MARINE PRODUCTS PROCESSING TRAINING CENTER, MANGALORE, MYSORE, INDIA

1. Introduction

Technological practices may be more easily transferred from one country to another in the field of industry than in agriculture. Agricultural technology to be transplanted requires receptive ecological conditions, while fisheries technology lies somewhere between the two. New developments in technology together with a careful study of local conditions go a long way towards facilitating its introduction in new areas. At the same time difficult food situations together with an evergrowing demand for high quality foods makes it essential to find substitutes for foodgrains. In so far as the high nutritional value of fish has now been recognised, it is not surprising that such countries as Japan, Norway, W. Germany, Peru and the Soviet Union have attached particular importance to promotional activities in this area. Today India, with a coastline of 3,500 miles aspires to become a major fishing country--and the introduction of new technology from abroad has been an important development along this road.

Marine products are highly perishable and in order that they should reach the consumer in perfect condition they require to be properly handled and processed. Correct preservation techniques acquire even greater importance when a country's export potential is taken into account. Today India exports some Rs. 250 million worth of processed marine products and to increase this figure due consideration has to be given to the development of the most modern fish processing methods on international lines. As hitherto both fishing and curing of fish were carried out according to traditional methods, the greater part of the country's fish production was consumed on the home market. It was only after independence that technical co-operation with fishing countries like Norway made it possible to take a great step in the right direction. In addition to technical aid, an all-round improvement in the situation of the advanced countries also had favourable repercussions on the situation in India. After 1952 significant modernisation was achieved in fish catching techniques, distribution, etc. There remained however a serious problem in the great scarcity of trained personnel for the preservation of fish and other marine products. It was hoped that by the application of modern processing techniques such as canning and freezing, it might be possible to exploit a far larger proportion of the resources available. With this end in view it was decided to seek technical assistance from Japan to set up a training center to initiate the fishing industries into modern processing techniques. In 1960 India sent a three-man delegation to Japan, and in 1961 the Japanese Government sent a fact finding mission to look into the situation. On 31st March 1962 an agreement was signed between the two countries to set up a marine products processing training center at Mangalore on the west coast.

2. Objectives

The aim pursued in establishing such an all-India training center was to provide the necessary training for technical personnel in the processing of marine products. It was hoped in this way to make good the serious lack of such qualified personnel, and also to re-orient the industry towards export. The Marine Products Processing Training Center (MPPTC) was inaugurated in July 1963. It became the first institution of its kind to provide training in fish freezing, canning and the preparation of fish ham and sausage. Thus the intention was to fill certain serious technical gaps in fish processing which was essential to any scheme for the take-off and balanced development of the industry as a whole.

The Government of Japan agreed to supply the necessary equipment, machinery, tools and training materials for the operation of the Center, as well as making available the services of seven Japanese teaching staff and technical personnel. At the same time the Government of India undertook to provide the necessary teaching staff to assist the Japanese experts; it also promised the necessary buildings, and took upon itself other running expenses connected with the maintenance and functioning of the training center. The Japanese experts were to impart practical and theoretical training in the processing of marine products with the assistance of their India counterparts. Five Indian officers were trained in Japan for this purpose. The Japanese Government provided materials, teaching aids, tools, etc. to the value of Rs. 1.2 million, while the cost of the building was Rs. 800,000.

The agreement was renewed for a further period of two years, from 31st March 1965 to 31st June 1967, and further equipment to the value of some Rs. 1.7 million was provided to cover this period. Subsequently, the agreement was still further extended under the Colombo Plan until 30th June 1969. By the end of this period arrangements were made for the Japanese experts to hand over their training duties--both theoretical and practical--to the Indian staff. Up to this period the Center was run by the Fisheries Department of the Government of Mysore. It was under the administrative control of a director, and the leader of the Japanese expert team was its technical head. After 30th June 1969 the Center was transferred to the University of Agricultural Sciences in Bangalore, where it continues to function in association with a Fisheries College. According to reliable information, it is intended in the future to continue the course at the Fisheries College up to the level of the post-graduate diploma.

3. Background

The MPPTC is located on the waterfront at the juncture of two rivers. Mangalore is a rapidly developing fishing center. The Indo-Norwegian project at Karwar, which was started in 1962, has resulted in the mechanisation of some 500 fishing boats in the Mangalore region. Mangalore is a collecting and distribution center for various kinds of fish, such as mackerel, sardine, prawn (or shrimp), shark and cat fish, as well as for agricultural products, such as mango, pineapple, cashew and other vegetables. This activity provides an excellent environment for the working of the Center.

The Kanara coastline is 180 miles long and fisheries in the region are considered to be more productive, particularly in mackerel and sardine. In 1956 a government freezing plant was set up in Mangalore and since then frozen fish has been exported. Today Man-

galore has five freezing plants, and numerous ice plants belonging to both the public and the private sectors. It is estimated that sales of frozen fish produce a revenue of Rs. 10 million. It is said that a few years ago landings of the traditional "rampani" were so abundant during the peak season that as much as 25,000 tons a year of fish was turned to manure, due to inadequate transport facilities. Today the establishment of ice plants has however considerably reduced this wastage. There are several fisheries high schools and primary schools, as well as government training centers that dispense training in modern fishing techniques. There are also many ice plants, cold storage, canning and freezing plants in the region. All these factors enhance the importance of the MPPTC and justify its location in the area. Indeed under these conditions the situation appears particularly appropriate for the training of technical personnel ("Indian Seafoods", Ernakulam, December 1969).

In addition to this and besides the existence of the Japanese training center and the Indo-Norwegian Project at Karwar, the Pre-Investment Survey of Fishing Harbours in 1969 had recommended the building of fishing harbours at Maple and Honavar in collaboration with Indian, Polish and Yugoslav consultants, at a cost of Rs. 180 million and Rs. 120 million respectively.

4. Performance

The Center provides a one-year training course in the processing of marine products, fruit and vegetables, for 30 students. Students from all over the country between the ages of 18 and 30 holding at science degree or a diploma in food technology are eligible to apply. At the end of the year's course a diploma in Fish Processing Technology of the Government of Mysore is awarded to the successful trainees. Trainees are also selected from government departments and private food industries. The first training course was opened on 1st July 1963. During 1963-1964 30 candidates were trained in the Center. The figures for succeeding years were 28, 30 and 25 respectively. In 1967 a postgraduate course replaced the original course and since then the 30 trainees per year have been awarded postgraduate Diplomas in Fish Processing Technology.

Japan, though recording an annual catch of some 7.2 million tons (India 1.4 million, Peru 10 million and the rest of the world 60 million) nevertheless, together with other advanced fishing countries, finds it extremely difficult to exploit the entirety of its resources. Indeed these countries have been able to exploit only a part of their marine resources and there are still great possibilities for increased fish production and fish farming, the latter still in its experimental stage. Japan is a fish eating nation and a leading country in the building of fishing boats. Guided by tradition, experience and the need to take radical action, it was quick to switch to modern methods of processing marine products, i.e. canning and freezing. Today freeze-drying, reduction, etc. have also been introduced. More than 200 species of marine products are landed. The greater part of the catch comes from deep sea fishing, coastal fisheries, and intensive fish cultivation in enclosed areas. It may be noted that fish farming over one hectare costs very little more than the farming of one hectare of land, the actual work involved being virtually less.

The Japanese lay stress on high quality of processed products, hygiene, careful handling and close attention to detail during processing. Modern cold storage and canning facilities today place the country's processing industry on a pedestal of its own.

India can learn a great deal from Japanese experience. It still relies exclusively on its coastal fisheries, whereas what India most needs is to develop deep sea fisheries backed by up-to-date

processing techniques. This then is where modern fish processing methods, such as freezing and canning (as practised in Japan and other advanced fishing nations) come into the picture, together with the Japanese technique of making fish ham and sausage. Following the example set by Japan, India clearly wishes to develop her deep sea fisheries and become a major exporter of processed products. The Center is made up of four sections, each under a separate head: freezing, canning, ham and sausage production, and engineering. The freezing section has a modern refrigeration plant with fully automatic controls. The technique applied is the contact plate freezing system, whereas the Indo-Norwegian Project has both contact and tunnel freezing. There are two cold storage rooms with an ante-room, and the cold storage doors are provided with automatic air curtains to maintain high efficiency. The preparation room is air-conditioned. The temperature in the cold storage room is maintained at -20°C. Most of the fluid in the fish is converted into ice, so that frozen fish may be maintained for a long time. Thawing is the final stage in the overall fish freezing process, i.e. defrosting. The "Refrigeration chain" permits control of "dessication, discoloration, dehydration" as well as other physical, histological and biochemical changes during storage. In fact the freezing process actually consists of the following stages: pre-handling, panning, freezing, packing and cold storage.

The canning section is equipped with different types of automatic and semi-automatic vacuum seamers. The canning process involves handling of raw material, weighing, packing, filling, seaming, boiler operations, retort operation, packing, sterilisation, storage, etc. A vacuum created in the tin by means of heat helps to preserve the flavour and vitamins in the fish, delays corrosion of the tin-plate, reduces pressure inside the tin during sterilisation, creates unfavourable conditions for the developlment of aerobic bacteria and prevents gaseous breakdown of products or proteins. Sterilisation (at about 108°C) inactivates tissue enzymes, destroys micro-organisms and transforms the raw fish into an edible product. It prolongs the shelf life of the product while preserving its nutritive quality. Frozen fish may also be canned after thawing.

The ham and sausage section is equipped with an automatic continuous cooker for the manufacture of fish ham and sausage in synthetic casings. The various operations involved are: selection of the raw material, treatment of the raw material, cutting, pasting, mixing, stuffing, sealing, cooking, cooling, drying, inspection, packing and storage. In fact the appearance of fish ham and sausage has been the most spectacular recent development in the Japanese fish processing industry. It was developed from the traditional fish-cake called Kamaboko as a result of a change in food habits and the need to utilise species unsuitable for the Kamaboko. The use of "butyl rubber hydrochloride sausage casings" and of preservatives such as sorbic acid have made the ham and sausage manufacture a flourishing industry. Sausage is invariably made from frozen fish. The flesh is separated from the skin and bone and washed (as in the preparation of Kamaboko). It is then passed through a food chopper and subsequently ground with addition of salt, vegetable oil and preservatives. Starch is added and the sausage mixture is stuffed into synthetic casings which are sealed with aluminium wire closures. The sealed sausages are processed for about one hour at 86°C in continuous water cookers. The aluminium closure prevents reinfection of the shelf life of fish sausage or ham. The preparation of the latter is slightly different from that of sausage which requires one month's preparation without refrigeration. Besides training in the processing of marine products like sardine, tuna, shrimp (prawn), mackerel, lobster, crab, the Center also provides training in the processing of meat, poultry, eggs,

fruit and vegetables.

In fact, the Center gives theoretical training in the following fields: general fisheries problems (such as fishing methods, utilisation, marketing, etc.) as well as fisheries by-products such as fish oil, fish meal; the chemistry and microbiology of food and fish; fish preservation (various methods such as smoking, curing, pickling, chilling, drying, dehydration, etc.); cold preservation of marine products, meat, fruit and vegetables; refrigeration (making of ice, freezing and cold storage); canning, preparation of fish ham and sausage; quality control and adjacent problems, and lastly the fundamentals of mechanical engineering in the food processing industry, including refrigeration.

Practical training accounts for 60 percent of the curriculum and includes training in food chemistry and microbiology, handling, operation of refrigeration machinery, freezing techniques, canning methods, preparation of ham and sausage, as well as the basic principles of operation of food processing machinery.

The purpose of the Center is to provide training in these subjects. It was not intended to have it undertake any other activities. It turned out to be difficult to assess the diffused impact and spread effect of this training based on techniques imported from Japan, a posteriori and any changes that occurred were the result of subsequent activities by men who had received training at the MPPTC. The Center worked on a non-profit basis, and the products processed were distributed locally at cost price.

5. Impact

There is no doubt that the training given at the Center has had favourable repercussions on the food processing industry in general. Former students are associated with or have been responsible for setting up canning and processing plants in the states of Tamil Nadu, Maharashtra and Orissa under government auspices, as well as in Gujarat on a co-operative basis. Many former trainees are now serving as chemists, quality control officers, technologists and production managers of food processing industries in the Central as well as the State governments. Apart from Indian personnel, two officers from Ceylon have also been given training at the Center. These technicians undoubtedly introduce into food processing the highest quality standards required for export of processed marine and other food products. ("Indian Sea Foods", Vol.V, No.2, 1967)

As a result of the training given by the Center, the number of food technologists working in the country has increased, and the plants they are associated with certainly process food products according to the most up-to-date methods and the strictest criteria of hygiene. The increase in fish exports may be attributed to improved processing methods, the initiative and dynamism shown by exporters of marine products and also the great need for foreign exchange. Whichever way one looks at the problem, there can be no doubt that the technicians trained at the MPPTC have played a most important role in this field of development.

The indigenous method of fish processing was chiefly salting and drying, and even today about one-half of the fish landed in the country is preserved according to these traditional methods, and consumed internally. Modern methods which attribute greater importance to canning and less to freezing have raised the export potential. In the region under consideration for example, the canning factories resort to the practice of ice-salting to can the fish. A 200 gramme can costs Rs. 2, whereas in the case of frozen fish the cost is more than five times as great. A government freezing factory at Mangalore employs the Japanese (or MPPTC) method of

fish freezing, as a result of which large quantities of frozen prawns are exported to the U.S.A. Indeed the demand for frozen prawns in the U.S.A. has been a considerable stimulus to the prawn freezing industry. Frozen fish are rarely canned. Large processing plants tend to export frozen fish, while the smaller plants export canned fish, fruit and vegetables. The former sell abroad, while the latter sell their canned food on the internal market. Fish ham and sausage are prepared in the Cochin region.

The training given by the MPPTC has undoubtedly increased knowledge and skills in the Indian fish processing industry. The country has moved fast to adopt modern methods of canning and freezing. This has resulted in larger quantities of fish being processed, and, compared to traditional methods, has increased the income derived from this activity. Formerly a 10 ton capacity freezing plant was an unheard of luxury. The development of food processing has also modified the pattern of consumption, just as this pattern has in its turn affected the food processing industry. As has already been remarked, a serious food situation makes it essential to find other sources of food and fish, in particular, when properly processed, finds a ready market. Properly processed fish retains its nutritive value and thus becomes a valid substitute for food grains. As more and more processing plants are brought into operation, employment possibilities also increase. Formerly only fishermen were employed in this type of activity; however, today the numbers employed in the processing industries have risen considerably as a result of the large numbers of technicians and skilled workers needed. The country's export earnings from marine products have soared to more than Rs. 250 million. This is obviously a stabilising factor in the adverse balance of payment situation. The fish processing plants have installed modern machinery and the high cost of buildings and equipment (greater than ever before) has brought about a situation increasingly favourable to savings and investment.

There is also a greater demand for sea-going "processing factories", as well as for the most up-to-date techniques such as freeze-drying and dehydration.

Processing of fish at sea has yet to be introduced in India but this will hardly be possible before India develops her deep sea fisheries.

6. Evaluation

It may be said that the project, in association with certain modernising trends characteristic of our time, has encouraged the Indian fish processing industry to adopt, to a large extent, the modern techniques developed in the more advanced countries. In fact this process should continue unless a revolutionary change occurs in the industry and the new methods introduced are used to supplement existing indigenous practices.

The Center has fulfilled the purpose for which it was set up, i.e. the training of technicians. In 1969 the Indian authorities, by then fully conversant with the subject, took over responsibility for the training course, and the Japanese experts, who had done their work with great enthusiasm, returned to Japan. It may be said that the Project has opened up new horizons for the Indian fish processing industry.

One former trainee of the Center stated that the Japanese experts, who were seven in number, had taught well and with spirit. They had themselves cleaned their rooms, which had encouraged their Indian counterparts also to sweep and clean. They had set a high

standard for hygiene, quality control, correct handling of raw material and careful attention to the details of the work. They had even insisted on shoes being changed on entering the preparation room! The results of their honest efforts can be said to be far-reaching. Another former trainee was frank enough to admit that the Indian counterparts did not share the enthusiasm of the Japanese, though later on, he added, following their example, they too became "leaders".

It was clear that there was an obvious and pressing need for technical know-how to be brought to this field, and this was achieved mainly through training. Transfer of this knowledge was possible owing to adequate "absorptive capacity" on the spot, and the imported technology did much to increase the profitability of local plants. The Project has achieved its purpose, though the impression remains that only part of the problem has been solved: graduates from the Center might well find themselves under conditions of control and supervision that would prevent them from disseminating the techniques they had acquired at the MPPTC. This possibility however is fairly remote, since as a general rule processing plants are eager to accept modern methods. Furthermore, it may indeed be true that in many spheres technicians as such cannot be prime movers. Nevertheless, the knowledge and techniques acquired by them would serve them in good stead in the plants employing them. Particular stress has been laid on hygiene and quality control. When compared with the Indo-Norwegian Project which covered fishing, processing, marketing and the overall raising of the standard of living of the fishermen, the work done by the MPPTC may not appear so sensational, but we nevertheless feel that it has made a contribution, however small, towards the development of the fish processing industry. There was no base from which to start the work (such as the Indo-Norwegian Project had in the fishermen of the region), but the beneficiaries were the trainees of the MPPTC and through them the food processing industry of the country.

The technical assistance provided here by Japan has enabled India to obtain more specialists in marine products processing, thereby developing its fisheries processing industry as a whole.

PART II CASE STUDY: THE INDO-NORWEGIAN PILOT PROJECT, KERALA, INDIA

1. Introduction

Kerala is the largest fishing state in India. It is the major exporter of processed fish to foreign countries. It has a short coast line (10 percent of all India) but produces 30 percent of total production. Fish eating is a regular feature of the diet. The types of craft used for fishing are dub-outs, plank built canoes and catamarans. Mechanised fishing has introduced boat seines, gill nets, drift nets for sardines, long lines for horse mackerel, coast nets and shore seines. The advent of mechanisation, apart from providing a stimulus to the building of motor boats, has encouraged the establishment of modern processing plants, thereby increasing India's production of sea-foods. Commercial trawling has existed for some twenty years, gill netting and purse seining being used side by side. Over the last two decades, and thanks largely to the Indo-Norwegian Project, the Kerala fishermen have been able, with the help of mechanisation, to make a breakthrough from traditional modes of fishing and consumption of fresh sea foods, or sea foods preserved for off seasons, to modern methods.

2. Objectives

The Indo-Norwegian pilot project was started in Kerala under a tripartite agreement concluded between the Governments of India and Norway and the United Nations on 17th October 1952. The objectives were to elaborate and transmit modern techniques and methods of organisation adapted to local conditions for the development of the fishing industry. The agreement also aimed at improving methods of locating and catching fish, as well as handling, processing and marketing. It was pointed out that the ultimate success of the Indo-Norwegian Project would not only substantially raise incomes, but would change the social and cultural attitudes of the local fishermen affected by the Project. It was felt that after finding suitable techniques it would be necessary to devise adequate means of transmitting and getting them accepted by the local fishermen. With these ends in view the INP began its pilot work in two neighbouring coastal villages six miles north of Quilon, Sakthikulankara and Neendakara.

The first Supplementary Agreement (Janaury 1953) covering the pilot project stated the following objectives in respect of the two fishing villages (Sakthikulankara and Neendakara):

(a) increase in returns for the fishermen's work
(b) efficient distribution of fresh fish and improvement of fish products;
(c) improvement of the health and sanitary conditions of the fishing population, and
(d) a higher standard of living for the community in the project area in general.

The second Supplementary Agreement (April, 1956), in addition to the objectives promulgated under the first, stressed the need for providing certain facilities in the Quilon district hospital and improving the supply of fresh water to areas adjoining the Project. It was also decided that a fishing center at Cochin should be started to train fishermen in the handling and operation of mechanised fishing trawlers and to study the economic feasibility of shrimp and fish trawling.

The third supplementary Agreement (November, 1961) was aimed at modifying and expanding the schemes already executed and extending the Project to cover the States of Tamil Nadu and Mysore. The new Agreement signed in 1967 defined the work to be done by the INP as follows:

(a) completion of the schemes initiated under the third Supplementary Agreement (1961);
(b) development of off-shore and deep sea exploratory fishing;
(c) practical training and demonstration of modern technology on land and at sea; and
(d) procurement of equipment for vessels and shore installations.

The present Agreement is to remain in force until March 1972.

3. Management

From the inception of the Project until April 1963, it was administered by the Kerala State Government, under the supervision of the Government of India and in consultation with the Norwegian Project Director. After the second Supplementary Agreement, as the main objectives of the pilot project at the two villages were attained, it was handed over to the Kerala Government with such of its units as the health center, ice plant and cold store, boat building yard, workshop and Premo pipe factory, etc. With that new centers were started at Cannanore (Kerala), Mandapam (T.N.)

and Karwar (Mysore), and work expanded at Ernakulam.

In 1963 the Government of India took over the administration of the Project at Cochin. Administration is now the responsibility of a Director in consultation, for important matters, with the Norwegian Project Director. The latter leads a team of 23 Norwegians particularly qualified in fisheries technology, engineering, navivation, processing, etc.

Norway has provided all the necessary equipment as well as the technical experts. To date, Norway has spent Rs. 120 million on the Project, while India's contribution has been Rs. 60 million.

4. Performance of the Project from 1952 to April 1963

The original project areas were intended mainly for carrying out experiments and disseminating the results of these experiments amongst other fishing centers. Even though the 1952 Agreement had envisaged an overall programme of development projects for the country, the bulk of the aid was for fishing only. Before the Norwegians came there had been no survey or description of the fishing community. Contact with the fishermen has now produced an interesting picture of the local fishing communities in the two villages (see reference (3) by A.M. Klausen).

In the villages of Sakthikulankara and Neendakara, Klausen detected a relationship between the Roman Catholics and the spirit of capitalism. Even though the Catholics constituted a minority group in the villages, they were modern in outlook, as compared with the other population groups--Araya, Nair, Irava etc. Klausen found that the Catholic community was more responsive to work done under the Project and acted as an opinion leader to other communities. The Catholics maintained closer contact with the Project and, being more developed, were quick to change to mechanised fishing, unlike the Araya community which was backward. But for them, the two villages would not have achieved their present stage of development.

(a) Mechanisation of fishing:

The traditional equipment of the Kerala fishermen included both seine nets and small (kochuvallam) and big (thanguvallam) canoes. Mechanisation came in with the Norwegians and resulted in an extension of the fishing grounds, greater security and new possibilities for overcoming the monsoon breakers. Furthermore, fishing methods were improved with the introduction of modern nylon nets for drift net fishing at night. Day and night fishing thus became a practical possibility in all seasons. The main advantages of the new methods were quicker landing of the catch, greater profits and reduction in size of crews.

Mechanisation of fishing craft was one of the main objectives of the Project from its inception. The work started with an attempt to mechanise existing canoes. It appeared, however, that "the possibility of their becoming viable economic units was found to be remote and, consequently, the idea of mechanisation of indigenous craft was abandoned. Efforts were then directed to finding new types of mechanised boats" (see P.153 Science and Technology, UN. Vol.III). The Project planned to design and build special types of powered craft suitable for local conditions. A boat buildyard was built in Neendakara in 1954, and Norwegian models were reproduced. In 1962 a new type of INP boat, rather bigger, with a more powerful motor and with trawl equipment, was built. Such boats have now found a secure place on the west coast. Up to the end of 1963, 143 boats of different sizes were constructed of which

125 were distributed to the fishermen at subsidized prices.

(b) Training

Motor-powered fishing requires skills very different from those needed for canoe fishing, both from the point of view of operation and maintenance. With a view to training fishermen in the handling and operation of mechanised fishing vessels, improved fishing techniques, manufacture of gear and fish handling, a training center for fishermen was established in 1955 offering a 6-month training course. A total of 167 fishermen were trained by the Center up to 1963. Special training in purse seining was given to 12 fishermen and 3 officers at Cochin. Besides these, 8 officers specialised in different branches of fisheries science and one physicist were trained in Norway.

(c) Preservation and marketing of fish

In order to ensure better preservation and marketing of fish, the Project introduced modern processing methods and established ice and cold storage plants at Neendakara. The Project organised a Fishermen's Marketing Co-operative Society to market fish in the hinterland (where fresh fish was not normally delivered) using imported insulated fish vans and freezing units. In 1961 the Fishermen's Sales Organisation (INP) Ltd. was formed. This created some concern among local fish merchants and it was found that a lack of mutual understanding between Project, fishermen and merchants could have serious consequences.

(d) Health and sanitation

It is interesting to note that the INP, in its attempt to raise the general standard of living of the whole fishing community, paid particular attention to public hygiene, sanitation and medical services. Originally the pilot project had consisted of three sections --fishing, health and construction and administration. A health center was established at Neendakara consisting of a maternity ward, preventive and curative clinics, a T.B. clinic, a family planning center, etc. Provision of clean drinking water was also found to be necessary. The project initiated a scheme to supply good drinking water from a lake to the Project area. A pipe factory was established which was later handed over to the Public Health and engineering department.

(e) Experimental and exploratory fishing

Exploratory prawn trawling carried out as from 1955 by 4 medium-size boats and 3 schooners belonging to the Project, besides proving the existence of prawn and the possibility of trawling for them, paved the way for commercial prawn fishing from Cochin. The Project's fishing boats successfully demonstrated the use of purse seining for sardine and mackerel for the first time in the country. One of the schooners also did a certain amount of marine research and collected much valuable oceanographic data. The Project assisted the Kerala University in building and operating a research vessel and oceanographic laboratory; it also helped the Central Marine Fisheries Research Institute with oceanographic research.

5. Performance of the Project from April 1963 onwards

A new era began in the history of the Project when it was taken over by the Government of India on 1st April 1963 and its activities extended to the states of Tamil Nadu and Mysore. The Project assisted the Kerala Government in building a fishing harbour at Cannanora. It undertook construction of a modern slipway and marine

engineering workshop at Ernakulam for fishing boats in need of underwater repairs.

(a) Exploratory fishing

Due to an insufficient number of large fishing boats, vast areas beyond a depth of 25 fathoms (1 fathom = 6ft.; 1.83 m.) had remained unexplored. Commercial fishing would benefit greatly if those areas could be exploited. To do this the Project acquired three modern trawlers from Norway in 1966 specially equipped for shrimp and deep sea trawling. Valuable data was thus collected at depths of between 25-60 fathoms extending from Karwar to Cape Comorin.

In 1967, trawling operations uncovered rich deposits of prawns west of Quilon. An area of about 1,000 square miles in this region at depths of between 175-200 fathoms was explored by two other research vessels. Lobster was also found. Survey work is to be undertaken.

Different types of gear are also being tried out in order to determine the types of most suitable for fishing deep sea prawn and lobster. The Project also started purse seining investigations of distant tuna fisheries in the Indian Ocean at present exploited commercially by Japanese and Soviet fishing fleets.

(b) Oceanographic and fisheries research

A research vessel was brought from Norway in 1961 and a vast area between Goa and Cape Comorin surveyed. The Central Marine Fisheries Research Institute at Mandapam also uses this vessel for research. The work done to date includes a study of the upwelling pattern upon which depends the success of much pelagic (between surface and great depth) and dermersal (on or near the bottom) fishing. A preliminary assessment of primary production along the west coast has been carried out. The Project has also assisted the National Institute of Oceanography, the Geological Survey of India and the Hydrographic Survey of India, and other institutions by providing facilities on board its research vessel.

(c) Training

The present Agreement provides for the training at the Ernakulam Center of skippers, mates, engineers and mechanics for boats, as well as shore technicians such as service mechanics, freezing plant operators and processing technicians. Seventy-five trainees have so far been trained in these fields. Besides 1,367 fishermen have been given training in fishing techniques (March 1969 figures).

(d) Mechanisation of fishing craft

In 1963 the boat building yard at Neendakara was handed over to the Kerala Government. The Project has established three boat building yards at Cannanore, Mandapam and Karwar. Imported marine diesel engines and other equipment are being supplied to these centers by the Project.

(e) Processing of marine products

Since it aims at introducing modern preservation methods, the Project has constructed three well-equipped ice and cold storage plants in the three centers and one at Ernakulam. These function with contact freezing as well as tunnel freezing. A fish meal plant has also been built at Mandapam.

A well equipped modern prawn processing hall and testing laboratory have been established at Ernakulam. Prawn processing for export was started with the raw material provided by Project vessels

since February 1967. The frozen product is exported to the U.S.A. and although the primary purpose of the processing unit is to introduce advanced fish processing techniques it is expected that it could in this way earn foreign exchange worth Rs. 1.5-2 million a year. The Project does not take raw material from the public, but depends on the catch brought in by its own fishing boats and government vessels operating from Cochin.

(f) Marine engineering

India now has more than 6,000 mechanised fishing craft, of which over 100 medium trawlers are 60 ft. to 100 ft. in overall length. There are however no well-equipped marine engineering workshops or dry dock facilities available exclusively for such vessels. Consequently, the larger vessels depend entirely on merchant shipping docks and workshops for dry dock repairs, which often results in loss of valuable fishing time. Being aware of this need, the Project has started work on a slipway capable of docking vessels of up to 120 ft. in length and a marine engineering workshop at a cost of Rs. 2.5 million--the first of its kind in the country.

(g) Distribution and marketing

In 1966 the Project established a modern fish stall at Alwaye equipped with a medium-sized freezer and storage room. In 1968 another stall was opened on Project premises. A number of other stalls are to be set up at various centers. This has made possible both better and more hygienic distribution and marketing of fresh fish.

Exploratory fishing, training of fishermen, mechanisation of craft, distribution, etc. are also being done in the other Project centers such as Mandapam and Karwar, both started in 1962.

6. Impact

The impact of the Project can be analysed in two ways--on the fishing population and on the fishing industry in general. The impact of the pilot project on the fishing communities of the villages of Sakthikulankara and Neendakara was far reaching. Klausen shows that the Catholics, with their spirit of enterprise, were able to adapt to the new situation more swiftly. The Araya community on the other hand, which was traditionalist in its outlook, lagged behind the Catholic minority resisting the changes introduced by the INP. They were reluctant for example to fish at night.

We have already seen that a major objective of this technical assistance Project was to improve the standard of living of the local fishermen. Indeed, it was able to increase income, output, employment and investment and improve skills in fishing and in the industry. According to Klausen the socio-cultural attitudes of the fishermen in the two villages have also changed. When mechanised boats were introduced the "Catholic fishermen, instead of waiting for the fish shoals to knock at their doors, went out for weeks to find the fish". This represented a major breakthrough in fish catching. The fishing grounds were thus extended and with modern equipment (echo sounders, winches, radio, telephones, electric lights, etc.) fishing as such underwent a revolution. Introduction of trawlers and nylon twines also further improved the situation.

The fishermen met the challenge of modern boats very enthusiastically. They were happy to "own" motor-powered boats from 1956 onwards. While the Catholics were very active and enterprising, the Arayas remained slow to accept the new techniques. It should

be pointed out that when the motor-powered boats were first build, profits from them were not very encouraging. But since then net per capita income has increased substantially. The following figures by Klausen give the net income per fisherman per year.

Rs.

Year	1959	1960	1961
22 ft. boat	251	764	616
Canoe	294	439	473
25 ft. boat	-	991	1,381

In 1959 the net income from the power driven boat was not very great. In subsequent years it certainly registered a sharp increase. The fishermen are clearly attracted by higher incomes, and if the motorboats had given no greater income than before, they would natutally have reverted to the old techniques. Only when deeply convinced through personal experience that mechanisation was yielding good results would they adopt the new methods. This approach has been in every way encouraged by the Project.

The co-operative movement in fish marketing launched by the Project on Norwegian lines was at first greeted with wry humour. It was not as successful as the new fishing techniques introduced in the region. "Co-operative sale of the fish would bar one of the most important courses of career since fishermen would all have to remain fishermen" (Klausen). The local fish merchants resisted the organisation as a result of which the Fishermen's Sales Organisation failed. This experiment taught the Project that the fish marketing problem could not be solved in a day and that co-ordination between the Project, the fishermen and the fish merchants was essential. In 1966 the market was in the hands of the private merchants.

The attempt by the Project to improve on existing canoes also failed and so entirely new types of boats suited to local conditions had to be built.

The health center had done valuable service in giving instructions about optimum diet and hygiene. It was noted that there was a marked increase in the average size and weight of a new-born child, by 2.54 cms. and 7 ounces respectively. The fishermen were able to get a good and stable income. From 1963 onwards, there was an increase in expenditure on non-food items. The annual average income increased from Rs. 325 in 1963 to Rs. 1586 in 1963. Indebtedness declined by 35 percent. Fishing, which was considered a menial job, began to be recognised and respected as a profession (Indo-Norwegian News Letter, October 1969).

Educational facilities and fisheries training with the aid of highly skilled techniques increased, as did employment opprotunities. The Arayas accepted government posts in the Project. Klausen states that the Catholic minority reacted well to innovations in fishing techniques and less well to the new systems of distribution. The Arayas, on the other hand, reacted poorly to mechanisation but favourably to all services made available to them by the Project's health section and administration.

The Project besides disseminating modern fishing techniques in the fishing community has also introduced modern methods in the processing plants, particularly with regard to frozen fish. The export of frozen shrimp and other marine products has increased and, doubtless due also to the Project, Kerala now leads the nation in fishing, and fish processing.

7. Evaluation

Rather than find appropriate techniques suited to local conditions, it is even more important to devise ways and means of transmitting them and getting them accepted by the fishermen. The Indo-

Norwegian Project has done valuable work in evolving techniques suited to the needs of local fishermen and in most cases these have been accepted. In the case of mechanised boats, the Catholic fishermen, who were more modern in outlook, adopted them readily whereas the Arayas gave preference to the distribution system and to improvements in hygiene.

Even though at first there was not enough profit, the fishermen were confident that with better equipment they would be able to go farther out and catch more fish. The coats gradually became more popular owing to such incentives as higher and more stable prices for the catch, which was not the case of canoes.

In the case of marketing the problem was more complex since it was largely sociological, coupled with difficulties in transport and distribution. We have seen that co-operative fish marketing did not catch on because of adverse local conditions. The fish merchants represented a social elite and denounced the co-operative, while the fishermen could not free themselves from their grip. Under the social conditions prevailing, fish flour and other new marine products could not yet be accepted. Fish eating is traditional and a change in food habits can only come with time. The traditional marketing system has to give way to a modern system. Unfortunately, the system introduced by the Norwegians failed, though nowadays co-operative marketing is common.

When the Norwegian experts arrived at Kerala they were struck by the poverty and homogeneity of the coastal population. They were able to reduce the povery but divided the population into two groups, one rapidly accepting the new technology and the other accepting it more slowly or rejecting it altogether. There was indeed an improvement in the standard of living and social status of the local fishermen. Economic growth denoting prestige would be a natural demand for institutional reform favouring more investment. Klausen quotes the village headman at Authenthura as saying: "we as fishermen have not profited from the Indo-Norwegian Project, it is rather the opposite. We have tasted the new ways of life and we see the advantages of mechanised fishing among the Catholics but as we are not able to operate the boats successfully, our misfortune becomes even more difficult to endure". The Project has now trained them to operate the boats more successfully and the picture is less dismal. The yardstick to evaluate the significance of the Project would be the extent to which the Norwegian technicians have been able to infuse in their Indian counterparts and in the fishing community a long-term notion of what the country needs to become a major fishing nation with facilities for modern ocean going trawlers, up-to-date fishing gear and the latest processing methods and repair yards.

Approximately Rs. 200 million have been spent on the Project and there are reasons to believe that this input will give adequate returns. The Norwegian Government has, since the beginning of the Project to the end of March 1968, spent about Rs. 92.4 million in grants. Furthermore, a credit agreement was signed on 16th September 1968 for a sum of Rs. 15.75 million. There has been some concern that too much time is being devoted to experimenting with new boats (the old ones being unsuited for mechanisation) and to providing instruction in their use. But developing countries require assistance in the conduct of research which goes beyond mere teaching and demonstration and which involves active participation in research. Developing countries need experts to evaluate resources in large ocean areas and inland waters to help develop tropical fisheries, etc. It has been suggested that programmes implemented by small groups of people are not likely to prove of much practical value (Science and Technology for Development, U.N., page 170).

This may be true but, once the number of local technicians increases, the stage becomes set for steadier and more rational development.

The impact of the pilot projects has been noticed not only on the original survey villages but also on the neighbouring and other fishing villages of Kerala. Of the 6,000 motor boats at present in use, more than half are in Kerala. Due credit must go to the Norwegians for having initiated the process of mechanisation. However, what India most urgently needs is that this stage of semi-mechanisation be succeeded by one of complete mechanisation, so as to bring about a "blue revolution" and make the country self-sufficient in food and products of high quality. New horizons are being opened up, though the problem is still far from being solved.

References:

1. Indo-Norwegian Project, Cochin (pamphlet)
2. Indo-Norwegian Project, Quarterly Newsletter, October 1969
3. Kerala Fishermen and the Indo-Norwegian Pilot Project, A.M. Klausen; The Norwegian Research Council for Science and Humanities, Oslo, 1968
4. U.N. Science and Technology for Development, Volume III, Agriculture, 1963

8. Institution Building Aspects in the Fisheries Project

(a) General remarks

In order to ensure that transfer of technology is fully effective many inputs are necessary. Of these the part played by institutions is particularly important[1].

When the institutions provide the necessary incentives, the transformation process is swift. Not only do the institutions help the transfer to be productive but they, in turn, benefit from the production process. When new technology finds suitable conditions in the region where it is introduced the institutional structure in the region is bound to change. In fact, wherever the transfer practice is effective it invariably affects the institutional and technological aspects causing them to modernise and adapt rapidly to the changing situation.

In the transitional stage of society values tend to change too frequently, in their turn modifying the institutional structure, and at the same time the factors making up the institution.

Normative relationships are said to exist when relationships between various factors abide by a common standard or norm. Those relationships do not purport to be positive in their nature or to characterise the factors as such. They rather determine standard behaviours to promote correct thinking. Thus, for example, where the institutional factor is the adoption of a new technology, the normative relationship explain how the new technology and the adopter of that technology are related. The normative relationship is not here a positive one, for it must comply with a standard acceptable to the adopter. Thus the action pattern depends on the attitude of the

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1) "Institutions" are functionally specific social organisations which incorporate faster and protect normative relationships and action patterns, and perform functions and services which are valued in the environment (Milton J. Esman and Fred C. Bruhns "Institution Building in National Development: an Approach to Induced Change in Transitional Societies", in Comparative Theories of Social Change, ed. by Peter W. Hollis, Ann Arbor, Michigan, Foundation for Research and Human Behaviour, 1966).

adopter within the framework of the process of adopting the new technology. This process has yet to evolve its own fully developed social organisation.

Institution building is the process whereby the normative relationship and the action pattern are established[2].

We maintain that it is the duty of the institution to build up both the one and the other. In doing so it may be said to be building itself. When the institution incorporates new ideas and actually protects them, these very ideas are automatically integrated into the existing social structure. Institution building is thus the process by which new ideas and functions are integrated into the society as a whole. When society is willing to adopt a new technology, that technology finds a place in the population and to this extent the institution is said to have been built.

We thus see that in the case of adopting a new technology the new institution penetrates gradually more and more deeply into the popular consciousness. When the adoption of an improved technology becomes socially worthwhile, we can say that it has helped to build up the institution. Institution building in fact may challenge the existing pattern of organisation and remodel it according to the requirements of the day. Thus, in the case of land ownership where the overall pattern is weak, institution building may require that the pattern be remodelled as an incentive to the adoption of new technology. The response of the prevailing social environment to the institution's activities are also brought out by the institution building aspect. In fact this may be compared to building new houses in order to lodge the facts more comfortably, or at least to repairing and readjusting the old ones.

(b) The marine products processing training center in Mysore

Here we are concerned first with the way the MPPTC succeeded in surviving in the face of the institution building process. This it was able to do through technical assistance and through the influence which, by contacts and agreements, it was able to exert on similar organisations (INP, etc.).

We now come to the variable factors inherent in the institution building process. The fish processing technology was brought from Japan and other advanced fishing countries. Traditional methods were inadequate and the processing techniques introduced by the new technology appeared novel, superior in that they were modern, and particularly suitable in that they were economic. Certain modern techniques of marine product processing such as freezing, canning and the making of fish ham and sausages were entirely new to the Indian fishing industry. Prior to the introduction of freezing and canning, fish were caught and processed by out-dated unproductive techniques. The new methods of the MPPTC (i.e. Japan and other countries) made possible quick hygienic processing of marine products as well as their preservation for long periods without deterioration of quality.

The new methods were considered superior to the old ones in that they were more modern and made it possible to satisfy the changing demands of the day. Another variable, the fact that the new methods were suitable, also played its role. In all activities involving transfer of technology, suitability to local conditions is paramount.

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2) Institution building emphasises (i) the creation of new organisations or the radical change or remodelling of the existing structure of organizations prevalent in the traditional societies, and (ii) the pattern of interaction between the institutions and their environment (Esman and Bruhns op.cit.).

Be it a case of full transfer, or only partial adaptation, if local conditions are ignored there is no chance of success. Suitability means that the local fishermen adopt the new technology (the mechanisation of boats for example) because they find it suitable, presenting certain advantages and capable of yielding higher returns. In all such cases the profit motive predominates. In the same way the adoption of freezing or canning techniques by a plant is motivated by the idea of profit.

It may be said that the three variable elements enumerated, as well as certain others, have been responsible for the institution building process in the introduction of new fish processing technology. They have been diffused into the society which is essential for the overall process and structure. Institution building thus sees to it that these new ideas are incorporated in the system and at the same time integrated into the region where the processing industry is located.

We will now discuss certain general aspects i.e. the institution building variables (besides those listed above), and the institution's contacts and dealings with other organisations.

(i) The MPPTC has played a leading role in providing training in freezing, canning, the preparation of fish ham and sausage and fisheries engineering. Being the only one of its kind, it has gained importance as a processing training center and set a valuable example to be profitably followed by others.

(ii) The objective of the Project was to train adequate numbers of technical personnel. Socially speaking, it aimed at a general raising of the status of the fish processing industry as a whole. The beneficiaries are the processing plants, through the technicians trained at the Center. Thus, when the goal is a valid one, from the social point of view, the building process may be said to be taking place.

(iii) Under the project programme each year 50 trainees were given training in various aspects of marine products, fruit and vegetable processing. Thus, an ever increasing number of specialists were made available to the industry as a whole.

(iv) The resources made available through technical assistance (teaching aids, staff, machinery, etc.) contributed substantially to building up the foundation on which the training was based.

(v) The internal structure of the Project itself made it possible to ensure training in modern techniques at all levels.

(vi) The variable factors already referred to above were closely interlinked, each and all pursuing the same objective--i.e. improvement of the structure of the fish processing industry and the introduction with the new techniques of a spirit of novelty, modernisation and appropriateness.

(vii) Control over the allocation of responsibility and the distribution of the resources needed by the Project was, generally speaking, in the hands of the State Government, while specific organizations supplied the candidates. We have analysed the impact made by a project on other organisations and the support it has obtained from them in the matter of recruiting technical personnel, finding resources and obtaining candidates. The Government, and in some cases private processing plants, sponsored some of their candidates for training at the Center. In this respect, the MPPTC was able to apply a criterion in the final choice, but plants requiring modern techniques had perforce to apply to the Project, and to that extent the latter's influence was strongly felt.

(viii) Relations of the MPPTC with institutions or agencies such as the Indo-Norwegian Project were based on the fact that the INP was also striving to achieve general improvement in the fish processing industry and raise the overall standard of living of the fishing community. In the Mangalore region and particularly at Karwar, the Indo-Norwegian Project has indeed rendered considerable service to the fishermen. Conversely the fishermen have increased fish catches thereby providing a ready source of raw material to the Center for further training in processing. In this regard the Project has again been able to exercise its influence on local fishermen's societies.

(ix) The processing plants employing trainees from the Center were also coaxed into aligning themselves on the MPPTC programme. At the same time, the work of the Project in such aspects as the training of qualified personnel, research etc. has also made it possible to extend education through field work. Complementary bodies which make use of these facilities also obviously tie in with the programmes of the Center. The processing plants which had originally supplied the trainee later recovered him as a skilled or more highly qualified worker. Sufficient research was not done and therefore in this respect the Indo-Norwegian project did not achieve all that it set out to do. Training was good and the trainees are now working as technologists, quality control officers, etc.

(x) Public opinion has on the whole reacted to the Project with enthusiasm. Though there is a strong desire to see it develop into another Indo-Norwegian Project, it is recognised that it has accomplished what was most necessary for the processing industry. The Government freezing plant at Mangalore has adopted the contact freezing technique as proposed by the Center and the management believes that the work of the Center has contributed vastly to an improvement of the processing industry in the State. The role played by information media has not been great; however, contact between the Project and the public has disseminated knowledge of modern processing methods and painted a colourful picture of the industry.

The work done by the Center has resulted in more technical personnel working in fish processing plants, an improvement in processing techniques, stricter quality control, more hygiene, a rise in exports of seafoods and greater economic and technical efficiency of the plants. These factors have all contributed to institution building and the introduction of the new technology.

(c) The Indo-Norwegian project, Cochin

The Indo-Norwegian Project became operational long before the MPPTC and covered the entire fishing industry from the landing of the catch to the final stage of the distribution of the product. The great novelty of the Project in the early 1950's was the mechanisation of fishing, which after a certain period became more profitable than the traditional method and was also an improvement in that boats could be operated at any time of the year and over long distances. This modernisation aspect, as well as the fact that mechanisation appeared to be particularly suited to conditions in the region, did much to enhance the prestige of the Project in its work on diffusion of the new technology. It took the lead in mechanisation and today there are more than 6,000 power-driven fishing craft in the country. Its goal of raising the standard of living of the fishing communities was to a large extent attained, particularly through better health and sanitation and more up-to-date catching, processing and marketing techniques. The programme became a valuable stimulus to the entire industry via mechanisation, bett-

er processing and improved distribution. The socio-cultural attitudes of the fishermen have been modified by the Project, a fact reflected in the enthusiasm of certain sectors of the population for speedy mechanisation. The Project has not only devised a suitable technology, but has in most cases been able to get it accepted by the local population. This has been particularly the case with mechanisation, though an attempt to introduce co-operative marketing of fish had been a failure.

Much training was given in fishing, engineering and processing techniques which went far in raising the overall level of the industry. Experimental and exploratory fishing by the Project's research vessels has opened up new vistas in deep sea fishing. The ice and processing plants set up by the Project constitute models for others to follow; the boat yards and other facilities are helping to increase the catch and the outlook of the fisherman has been favourably modified and modernised. The Project has exercised an influence on numerous plants, as well as on the Central Institutes for Fisheries Research, Fisheries co-operatives, Fisheries Education, the Marine Fisheries Research Institute and others, at Ernakulam, Mandpam, etc. Project initiated work in freezing techniques is also being done at the MPPTC, Mangalore. Contact with the public through information media is encouraging and the population feels a debt of gratitude to the Project for having raised the standard of living of the fishing communities in the region and generally improved the state of the industry.

(d) Conclusions

Both projects (the MPPTC and the INP) have common ground between them and they have been able to institutionalise themselves on the basis of the working principles and contacts described above. The fact that the new technology is economically sound and technically easy to apply, that it has been found suitable by those who have adopted it, as well as its manifold advantages over traditional practices--all go to enhance the validity of the institutional aspects. The projects have been instrumental in introducing new ideas and creating new functions through modernisation of fishing, processing, marketing, etc. The socio-cultural attitudes have also undergone a steady change. In addition to the introduction of the new fisheries technology together with the benefits derived from it, new institutions have been built up which have integrated the new processes. As a result of the operation of these institutions, fishermen's marketing societies have sprung up. Many modern processing plants have been built, many trained workers made available to the labour market; export of seafoods has increased, quality has improved, mechanisation has been intensified, the reputation of the fishing industry enhanced, the relationship between new techniques and practices, and those adopting them stabilised, and finally, patterns for future action established. In short, these projects have greatly contributed to institution building and the process in this developing country is bound to pursue its course as a tremendous amount still remains to be done.

Comments on Tabe's Paper - Seiji Naya

Dr. Tabe presents a very positive and favorable impact that both the India-Japanese training and India-Norweigian projects have had on the development of marine products and training of skilled labor.

For a number of reasons, projects of this type can be successful and pay off can be great. The first is the consideration of the factor endowment. Indian Ocean is known to contain a vast amount of fish and marine resources. In the past, these resources have hardly been exploited, unlike in the case of the Atlantic and Pacific Oceans. The recent increase in the tonnage of fish produced from the Indian Ocean has been accounted for mainly by four non-Indian Ocean countries, Japan, Korea, Taiwan and Russia. Secondly, world demand for fish and other marine products has been rising rapidly. Thirdly, because the fishery involves a relatively simple rather than high technology, the adoption and diffusion of technology have been made easier. Finally, these two projects are concentrated not on the national level but in a certain limited number of closely linked villages where the fishery is the major occupation.

Two projects are related but differ considerably with regard to the scope, expenditures and objectives. The Indo-Norweigian project covers the entire fishing industry from the landing of the catch to the final stage of the distribution of the marine products, as well as research.

On the other hand, in the case of the India-Japan project, training of labor skill in the processing of marine products, vegetables and fruits is its basic objective although Dr. Tabe does not fully high-light this. The problems and difficulties associated with the Norweigian project are likely to be greater than those of the Japanese project. Modern fisheries require an urban rather than the rural base of operations involving motorized vessels, fishing harbours, storage facilities and access to markets.

Dr. Tabe points out certain indications as the sign of success for these projects. For example, income, foreign exchange earnings and employment are said to have gone up as the result of these two projects. But no systematic figures are provided and no attempt is made to qualify possible benefits and costs of the projects. The only income figures cited are of 1959 to 1961 or those of some 15 years ago. Certain crucial figures such as prices, the size of exports in relation to total products, the export and domestic market distribution are not given. Although the author describes that the Catholic group has adopted the mechnization of fishing boats more readily than the Araya group, no statistical information on such factors as income distribution is presented.

While the Norweigian project still goes on, the Japanese project was terminated in 1969, when Indian authorities took over responsibility for the training course. Dr. Tabe states that Indian staff became fully conversant with the subject and Japanese experts were no longer needed. Does the disengagement symbolize Indian success in obtaining the new capacity to produce trained man-power in the field? Or to what extent, did this indicate the end of politically pre-determined technical assistance?

As a whole, the paper does deliver the main and important mess-

age. Namely, transfer and diffusion of technology especially in a field such as fisheries can't be expected to occur as a spontaneous process. Rather, it requires institutionalized channels of action and assistance to identify and adapt a most appropriate technology and to increase the absorptive capacity.

PART IV

TECHNOLOGY AND COMPARATIVE ADVANTAGES IN TRADE

11

THE CHOICE OF TECHNOLOGY AND THE FULL UTILIZATION OF RESOURCES

NAK KWAN KIM*

Introduction

Before the end of the Second World War, the southern part of Korea was predominantly an agricultural product producing economy and most of the manufacturing facilities were located in the northern part of the country. The division of Korea in 1945 led to those industrial facilities, including major electrical power generating complexes, being absorbed into the north. Whatever progress the Republic of Korea made after the division was virtually erased when the country was devastated by the Korean War of 1950-1953. Persistent inflationary pressures threatened the daily lives of the rapidly growing population which was swelled by massive migration to the southern part of the country.

The Republic of Korea not only suffered from an acute shortage of vital manufacturing goods but was also troubled by severe shortages of staple foods. The unemployment situation steadily deteriorated and this caused considerable social unrest.

During the eight years following the cease-fire, the Republic of Korea strove to recover from the economic catastrophe caused by the war, relying heavily on foreign assistance, much of which was in the form of grants-in-aid. A large amount of final consumer goods flowed into the country to help the population to sustain a subsistence standard of living. However, it was far from sufficient to bring about self-propelling economic growth. Most of the population had to suffer stagnant, if not deteriorating, economic conditions and intolerable social injustice.

In an attempt to save the country from economic collapse, the armed forces assumed control in 1961 and gave top priority to economic development. The new dynamic Government realized that not only would the foreign grants-in-aid not continue forever but also that reliance on such aids alone would never solve the basic economic conditions of the country: the country itself had to be self-motivated. Drastic changes in basic economic development strategies were needed to accelerate growth on a sound basis and the Government launched an ambitious industrialization scheme placing the

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strongest emphasis on export expansion.

The new Government exerted a strenuous effort to create employment opportunities by injecting huge doses of capital into manufacturing industries and social overhead capital, such as electricity and transportation. Monetary and fiscal policies were redesigned in order to be effective in mobilizing domestic financial resources and to channel them into economically productive industrial sectors. Doors were also opened wide to attract foreign capital to supplement newly adopted economic development strategies. Demands for foreign capital goods and raw materials were stimulated as a result of carrying out outward-looking strategies. Foreign borrowings became necessary to finance a part of the vigorous investment drives, but it was clearly understood by both the public and the private sectors that foreign loans would have to be repaid with interest. Ancicipating the mounting pressure of foreign debt servicing on the economy and the continued needs for imports, the Government adopted a vigorous export-first policy.

This paper will seek to investigate how the Republic of Korea has been striving to attain maximum utilization of available resources and what are the visible and invisible consequences, including choice of technology, resulting from persuing such policies.

1. Inward- and Outward-looking Policies

In retrospect, there was a notable change in the country's economic development strategies during the past two decades, 1953-1973. The economic policies up to 1961 may be characterized as inward-looking and those of the subsequent decade may be said to be outward-looking.

In the first period, there were a few industrial plants for such industries as textiles, flat-glass, bottling, cement, sugar refining, and wheat flour milling, brewing, newsprint and rubber. Many of them were wholly or partly financed by foreign grants-in-aid,and a large part of the raw materials, except those for flat-glass and cement, were provided by foreign assistance. Almost all of them were produced for domestic consumption. Under such economic conditions, the entrepreneurs and businessmen inevitably focused their attention on securing raw materials and other price-inelastic commodities allocated by foreign grants-in-aids. Since the quantity of those allocated foreign grants-in-aid goods was usually insufficient to meet effective demand in the domestic market, the profits of the businessmen were almost always assured. The government's manipulation of quotas for such goods have resulted in many unhealthy incidents. Domestic currency was considerably over-valued at the official rates but those exchange rates were limited to such cases as sale of Korean currency to foreign residents in the country and remittance of foreign exchange to students abroad.

Moreover, persistent inflationary pressures coupled with acute shortages of domestic capital virtually eliminated any possibility of effectively channelling domestic capital to development of manufacturing industries. Any financial resources were directed to economic activities of a speculative nature in which the yields of capital were considerably higher than the long-term capital investment in the manufacturing industries. Banking loans were limited to the government-favoured industries and these were often charged negative interest rates.

In such an economic system, it was virtually impossible to expect entrepreneurs to make efforts to increase labour productivity and improve the efficiency of managements. No one perhaps even considered the possibility of introducing advanced technology into the economy. The economy continued to be stagnant and just relied on foreign assistance. This is one of the reasons why the rate of increase in creating employment opportunities was far below the rate of increase in the economically active population, which subsequently made the unemployment and even underemployment situation worse. Entrepreneurs paid very little attention to eliminating the inefficient factors in their economic units, thus adding fuel to inflationary pressures already acute in the country. This, in turn, served as a disincentive to employed as well as unemployed workers and their families who suffered while a handful of windfall profit making entrepreneurs enjoyed conspicuous consumption.

The rural sector of the economy also deteriorated. The pricing policy for agricultural products was badly designed and managed, and thus failed to provide any incentives to increase farm outputs. The fact that farming incomes were so low stimulated large numbers of the rural population to move seasonally to urban areas in the hope of earning, not saving, some wages to solve their daily food problems. This worsened the unemployment situation in the urban area. When such an economic system was deeply rooted, any foreseeable sharp decline in foreign grants-in-aid was certainly a big blow to the country.

Despite all those economic stagnation and slumps which seemed to last for many years, no one overlooked the necessity for providing education for children even if they entailed the sacrifice of their livelihood. However, a large portion of the country's intangible assets, human capital, were wasted because the economy was incapable of providing employment oppurtunities in such a way that they could effectively exploit the use of whatever skills they had acquired. In other words, the country failed to make full use of its major available economic resources, manpower.

As was mentioned earlier, the new dynamic Government adopted new economic development strategies which may be characterized as outward-looking economic growth models led by the export expansion scheme. Domestic currency was devalued and frequently adjusted to attain the national goals.[1] Various schemes, such as direct subsidies, and an import linking system, were used to provide incentives for exporters by allowing the selling of a certain quantity of imported goods in the domestic market. Tax exemption and exemption from import duties were provided for importation of goods which would be used for producing exports. The wastage allowance (or technical gains) system has been applied under which a part of imported raw materials can be processed and sold in the domestic market at much higher rates than exports at prevailing exchange rates. The favourable banking credits bear considerably lower interest rates for exports. Although there are many economic defects [2] in such export promotion schemes, it certainly brought in a sizable amount of foreign exchange and helped substantially to activate industrial development and increase incomes. The creation of both direct and indirect employment opportunities has been enormous.[3]

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1) Nak Kwan Kim, "Is Korea's Export Promotion Scheme Consistent with Her Industrialization?", Asian Economies, Research Institute of Asian Economies, Seoul, June 1972.
2) Ibid.
3) Youngil Lim, "Impacts of Exports on Output and Labor Absorption in South Korea", (mimeographed), East-West Center, University of Hawaii, Honolulu, Hawaii.

A generally observed phenomenon is that developing countries usually start with import-substitution industries and later shift to export some of their products. Many commodity exports of the Republic of Korea have gone through this process. However, in some instance, the Government encouraged development of export-oriented industries which did not go through such a stage. Some of the spare part assembly plants and bonded factories may belong to this category. A large-scale shipbuilding industry recently launched in the country may also be cited as an example.

Although a large portion of capital goods and technical know-how has had to be imported and production had to be supervised to meet international standards during the initial stage, it undoubtedly contributed to the increase in value added in the economy. It will certainly activate the economy, in varying degrees, to supply intermediate products to such industries. Such stimulants will be shared both by existing industries and those which are yet to come into production. One of the strikingly advantageous factors is that the suppliers of the capital goods and technological know-how generally bring in superior kinds if their products are mainly for export rather than for the domestic market. Under such a scheme, the ratio of net foreign exchange earnings to a unit of exports may not be as high as the economy wishes to attain during the early stage. However, such ratios will increase as efficiency in production rises. Managerial improvements, increase in labour productivity, introduction of up-to-date advanced technology, and the activation and the improvement in efficiency in the related industries will help to raise such ratios. This scheme will also give tremendous intangible assets in quality of human capital in all facets which cannot be quantitatively measured.

Under the outward-looking development strategy, the country vigorously carried out an industrial development scheme of an import-replacing natures in both competitive and non-competitive industries. Direct credits at the concessional terms were extended to high-priority industries. The non-tariff and tariff barriers were employed mostly for protective measures. To attract the inflow of foreign capital needed to supplement development financing, guarantees were given for the repayment of foreign borrowings for priority industrial projects. Although there may be some arguments against the provision of such assistance,[4] it may seem reasonable for a developing country, such as the Republic of Korea, to initiate projects with those measures. However, it is necessary to note that the Government should gradually reduce the extent of protection in order to accelerate the competitive strength of those industries on the international front. The continuous provision of protection to those industries which do not strengthen their international competitiveness and at the same time do not have much linkage to other domestic industries may not make much sense from the national economic welfare point of view. Under this new strategy, most of the import-replacing industries are geared to export their products in the shortest possible time. In other words, import-replacing industries will be urged to be efficient by increasing their rate of productivity. In order to be efficient, they will strive to adopt up-to-date technologies and adjust the scale of the industries to the economic optimum according to international standards. Managerial improvements will become essential so as to become competitive in the international markets. Such an effort will be further stimulated by the fact that they are obliged to repay foreign debts in terms of foreign exchange. This implies that they have to render direct and/or indirect contributions to export.

One of the new economic policy measures adopted within the frame-

4) Nak Kwan Kim, op.cit.

work of the outward-looking economy strategies is the promulgation of foreign capital inducement laws. It provides handsome incentives to those who extend loans and to direct investors. The Government, of course, examines whether such loans and direct investments are in harmony with the country's industry and infrastructural development schemes. Political stability with strong economic development minded leader-ship, rapid economic development performance coupled with availability of a relatively cheap and industrious labour force, accessibility of plant sites, and other infrastructure are some of the factors which have attracted a sizable amount of foreign capital into the economy. Although such a large inflow of foreign capital might have been causing some concern, as long as the economy is capable of repaying, by sufficiently increasing net foreign exchange earning, it should not impose any serious burden on the economy. The large inflow of capital and investments has undoubtedly contributed much to the huge increase in employment opportunities and also helped to accelerate the economic growth. The imported foreign capital goods and productive facilities have been bringing advanced technologies embodied in them. This provides opportunities of acquiring skills and experience of advanced technologies in diversified areas to a greater number in all the different classes of occupations, thus adding greatly to the country's intangible assets. Moreover, it will not only generate skill endowments in a static sense but also upgrade the quality of manpower which can be easily converted to any new types of more sophisticated industry which will be developed in due course.

2. Over-all Economic Growth Performance and its Financing

A drastic upswing was recorded in the economic growth rate during the second half of the period under study, 1963-1965 to 1970-1972. In the first half of the period, GNP, in terms of 1970 constant market prices, rose only 1.2 percent points higher than population growth rates, and private consumption expenditure rose at a rate slightly higher than that of GNP. The ratios of private consumption expenditure over GNP rose from 80.2 percent in 1953-1955 to 82.3 percent in 1960-1962. Gross investment, which was equivalent to a meagre 7.1 percent of GNP in 1953-1955 rose only slightly to 9.5 percent in 1960-1962. During this first period, some sectors, such as manufacturing industries, mining and quarrying and construction works and electricity and transportation, registered progress, but those sectors share of total value added was only 11.8 percent in 1953-1955 and 18.7 percent in 1960-1962. The agricultural sector was virtually stagnant. Moreover, it should be noted that the high growth rates in some sectors of the economy were largely attributable to the fact that the base year of the comparison is the year when the economy was devastated by war.

The per capita GNP in 1962 was equivalent to only $102, although, in the subsequent years, it attained the considerably higher rate of 10.1 percent. The leading sectors of the growth were manufacturing, construction, and the social overhead capital sector, particularly electricity and transportation. Much effort was exerted to develop the agricultural sector but its performance was not as good as other sectors of the economy. Marginal propensity of private consumption expenditure with respect to GNP steadily declined over the years. This may be largely attributable to income increases and the Government's concerted effort to provide a favourable climate for investment. Per capita GNP in 1972 rose to $298, thanks partly to the success achieved in reducing population growth rates during the decade.

Since external transactions played an increasingly significant

Table 1 GNP and its Industrial Origins

(in thousand million won at 1970 constant market prices)

	Annual average of three years				Annual compound rates (%)	
	1953-1955	1960-1962	1963-1965	1970-1972		
	A	B	C	D	B/A	D/C
GNP	890.65	1,178.39	1,433.33	2,813.24	4.08	10.11
Private consumption expenditures	714.45	970.33	1,126.94	2,063.47	4.47	9.03
Gross domestic fixed capital formation	63.32	111.61	172.77	663.32	8.43	21.19
Exports of goods and services	13.37	36.20	61.17	494.64	15.29	34.80
Imports of goods and services	97.42	121.79	154.04	739.07	3.24	25.11
Industrial origin of GNP	890.65	1,178.39	1,433.33	2,813.24	4.08	10.11
Agriculture, forestry and fishing	421.18	493.65	583.10	744.66	2.29	3.56
Mining and quarrying	7.86	16.70	22.14	31.05	11.37	4.95
Manufacturing	62.13	130.04	186.06	660.67	11.13	19.84
Construction	15.98	29.13	43.55	149.75	9.06	19.30
Other services and social overhead capital	372.18	501.22	590.31	1,227.85	4.34	11.03
- Electricity	3.45	8.11	12.59	51.64	12.99	22.34
- Transportation	15.70	36.68	54.83	166.05	12.89	17.15

Source: Bank of Korea, Economic Statistics Yearbook, 1973.

role in the country's economic growth process during the second phase, trade aspects will be further elaborated. As shown in table 2, exports of commodities registered an annual compound rate of 32.1 percent. This is quite impressive if it is compared with export growth performance during the earlier years. While commercial exports still occupy the lion's share (79.6 percent in 1970-1972), exports from the bonded processing zone undoubtedly contributed greatly to the increase in exports during the 1960s. Export of manufactured goods (SITC 5-8) was equivalent to 49.0 percent of the total export of goods in 1964, but it rose sharply to 82.1 percent in 1971.

During the first seven years under study, a large portion of imports was financed by foreign grants-in-aid. However, in the 1960s, imports financed by the country's earned foreign exchange showed a great increase and the foreign loans turned out to be an increasingly important source of financing imports which are needed mostly for the country's industrial and infrastructural economic development. In 1970-1972, the foreign grants-in-aid represented only 4.2 percent of total commodity imports. The imports of machinery, transport equip-

Table 2 Commodity Trades by Channels

(in million US dollars)

	Annual average				Annual compound rates of changes (%)	
	1953-1955	1960-1962	1963-1965	1970-1972		
	A	B	C	D	B/A	D/C
Exports						
Total	27.3	42.8	127.0	1,175.6	5.8	32.1
Commercial	27.3	41.1	113.7	936.0	5.3	30.2
Bonded process	0	0.03	8.9	215.5		48.9
Others	0	1.4	4.4	24.2		23.8
Imports						
Total	310.0	360.5	476.0	2,300.0	1.9	21.8
Commercial	118.7	126.4	221.9	1,524.7	1.9	27.2
Official	191.3	215.7	170.2	96.2	16.2	6.9
Foreign loans	0	1.5	39.4	523.4		38.2
Relief and others	0	16.8	44.5	155.9		17.0

Source: As for table 1.

ment, mineral fuels and other raw materials contributed greatly to the increase in imports. Insufficient outputs of food staples continued to disturb the country's balance of payments position.

In order to activate full participation of manpower for economic growth, the Government started to mobilize both domestic and foreign financial resources and channel them into productive industrial and related sectors of the economy. Fiscal policies were restructured to be effective in tapping the financial sources without causing adverse effects on the economic growth activities. Monetary policies were redesigned to encourage savings and utilize them for economically productive means at continuing base. Implementation of such policies may have helped to boost national savings, which contributed 45.4 percent of total investment in 1963-1965 and 63.0 percent in 1970-1972. The economy has also been successful in channelling foreign borrowings to supplement its economic growth efforts. These foreign borrowings were used largely for the importation of capital goods for diversification and expansion of the country's productive capacity and for development of social overhead capital, such as electricity and trnasportation. Net foreign borrowings financed only 6.8 percent of total investments in 1963-1965 but their share rose to 27.5 percent in 1970-1972.

The Government anticipated that foreign loans and direct foreign investment would continue to play an important role in the country's economic growth processes. However, it is also expected that the ratios of repayments of principal loans (excluding those for less than three years) and interest plus remittance of profits incurred from direct investments to current receipts from invisible and visible trade will be reduced from 14.8 percent in 1973 to 8.8 percent in 1981. The inflow of foreign capital and the effective mobilization of domestic financial resources have helped to finance vigorous investments in manufacturing and in such infrastructural sectors as electricity and transportation and construction in order to make the economy operationally efficient.

Table 3 Financial Sources and Investments by Industries

(in thousand million won at current market prices)

	Annual average of 3 years				Annual compound rate (percentage)	
	1953-1955	1960-1962	1963-1965	1970-1972		
	A	B	C	D	B/A	D/C
Gross domestic capital formation	9.76	37.02	104.83	771.83	20.98	33.00
Fixed capital formation	7.10	36.48	89.55	720.05	26.34	34.69
Agriculture, forestry and fishery	0.80	4.09	10.11	65.65	26.25	30.64
Mining and quarrying	0.05	0.30	1.05	4.77	29.17	24.14
Manufacturing	1.49	7.45	22.28	142.60	25.86	30.37
Construction	0.03	0.74	1.46	9.66	58.08	30.99
Social overhead capital and other services	4.74	23.91	54.65	497.37	26.01	37.09
-Electricity, water and sanitary services	0.35	3.05	7.36	60.64	36.24	35.16
-Transportation, storage and communication	1.18	8.22	19.09	198.32	31.96	39.71
Increase in stocks	2.66	0.54	15.28	51.78	-20.37	19.05
Total investment	9.76	37.02	104.83	771.83	20.98	33.00
National savings	4.83	6.87	47.64	486.26	5.16	37.36
Foreign savings	4.93	28.08	51.01	272.78	28.21	27.06
-Net borrowing from the rest of the world	1.06	0.64	7.10	212.12	-6.97	62.47
-Net transfers from the rest of the world	3.88	27.43	43.90	60.66	32.23	4.73
Statistical discrepancy	-	2.08	6.18	12.79	-	10.95

Source: As for table 1.

3. Availability and Use of Human Resources

The discouraging economic performance and its gloomy economic prospects were further disturbed by a continuously high annual population growth of 2.9 percent up to 1962. The new Government has been carrying out effective family planning schemes throughout the country and as a result the population growth rate has been steadily declining year after year and fell to 1.9 percent in 1972. The population is estimated to be 32.4 million in 1972. Despite all the economic hardships, the Government and the general public have never overlooked the essential need for giving education, and this

Table 4 Educational Level of Population (6 years old and over) in 1970

	Total		Male		Female	
	Thousand persons	percentage	Thousand persons	percentage	Thousand persons	percentage
Population	26,261	100	13,108	100	13,154	100
Attending schools	7,945	30.25	4,352	33.20	3,594	27.32
11-9 years	7,118	27.10	3,818	29.13	3,300	25.09
10-12 years	616	2.35	379	2.89	237	1.80
13 years and over	211	0.80	154	1.17	57	0.43
Not completed	815	3.10	498	3.80	317	2.41
1-9 years	569	2.17	294	2.24	274	2.08
10-12 years	113	0.43	87	0.66	26	0.20
13 years and over	133	0.51	116	0.88	17	0.13
Graduated	12,375	47.12	6,462	49.30	5,913	44.95
6 or 9 years	9,779	37.24	4,618	35.23	5,162	39.24
12 years	1,893	7.21	1,288	9.83	605	4.60
14 or 16 years & over	703	2.68	557	4.25	146	1.11
Never attended[a)]	5,125		1,796		3,329	
Can read and write	2,187		972		1,215	
Cannot read and write	2,299		514		1,785	

Source: Government of the Republic of Korea, Economic Planning Board, 1970 Population and Housing Census Report.

a) Persons whose ages were 10 years or over were surveyed.

has contributed greatly to the accumulation of huge intangible assets in the country.

Because of the extreme complexity, it is virtually impossible to give even a rough estimate of the quality and quantity of the human capital available in the country. An interesting exercise[5)] has been carried out to obtain a rough aggregated magnitude of those factors of the country's human resources. It revealed that, in 1972, direct and indirect investments in formal education (excluding investments in compulsory education and primary schools) were equivalent to about 22.8 percent of GNP. The same study also estimated the average annual growth rates of human capital to be 9.9 percent during 1960-1971. During the same period, the physical capital rose 6.8 percent, and this subsequently increased the ratio of human capital over physical capital from 62.7 percent in 1960 to 86.3 percent in 1971.

The other general way of looking at the quality and magnitude of the available manpower in the country would be the ratios of the population at different educational levels and its illiteracy rates. The 1970 Population and Housing Census Report revealed that 50.2 percent of the population of 26.3 million more than six years old had graduated or at least attended schools, while 30.3 percent of that 26.3 million were attending schools. Although 19.5 percent of that 26.3 million had never attended schools, 42.7 percent of them were not illiterates. It also revealed that the majority of the illiterates belonged to old-age groups There was some indication of discrimination against female eduction but it was only of slight significance.

5) Y.H. Nam and I.Y. Cheung, Analysis of Economic Value of the Investments in the Education in Korea, Korean Development Institute, Seoul, July 1973, (mimeographed in Korean).

Table 5 Population and Economically Active Population

	1963	1967	1971	Annual compound rate of changes 1967/1963	1971/1967	1971/1963
	(in thousand persons)			(P e r c e n t a g e)		
Population	27,184	30,067	32,429	2.55	1.91	2.23
Economically active population						
Farm	5,281	5,315	4,918	0.16	1.92	0.89
Non-farm	3,372	4,189	5,247	5.57	5.79	5.68
Employed						
Farm	5,129	5,191	4,846	0.30	-1.70	0.71
Non-farm	2,818	3,723	4,862	7.21	6.90	7.06
Unemployed						
Farm	152	124	72	-4.96	-12.71	-8.92
Non-farm	554	466	385	-4.23	- 4.66	-4.45

Sources: Bank of Korea, Economic Statistics Yearbook 1973.
Economic Planning Board, Annual Report on the Economically Active Population, 1971

As mentioned earlier, the huge dose of domestic and foreign capital that was channelled into various sectors of the economy created additional employment opportunities and activated demand for all classes of workers. Many unemployed begin to find paid jobs and semi-skilled workers were encouraged to train themselves to become skilled workers as incentives and prospects of better employment opportunities became available. Since the second half of the 1960s, many industries have begun to feel acute shortages of certain kind of skilled workers, technicians and engineers and this will undoubtedly be intensified as the country actively pursues aggressive industrial expansion strategies of a diversified nature. Such phenomena were clearly reflected in the increase in wages for workers.[6)]

The widespread communications and availability of employment opportunities which require both skilled and unskilled workers in manufacturing industries may help to shift workers from low productivity industries to higher productivity industries. The employment migration from rural areas to the urban areas in all age groups is also quite remarkable. The reduction of males employed in farm households and the sharp increases in those employed, non-farm households clearly illustrate dynamic changes in employment migration in the economy. The large employment migration of males of productive age groups to non-farm households is worth noting. The attraction of higher incomes and the greater demand for female workers as a result of rapid expansion of labour-intensive industries coupled with social changes breaking the traditional rigid social system which used to discourage female participation in non-household work in rural areas may have stimulated the flow of a huge labour force to economic activities in urban areas including manufacturing and its related industries. The growth rate of female employees was higher than that of male employees during the later 1960s. It should be noted that increases in employment in manufacturing industries and in the social overhead capital sector for both male and female are quite significant, while employment in primary industries generally declined during the period under study.

Implementation of such aggressive economic development strategi-

6) Korean Development Bank, Monthly Economic Review, November 1973

Table 6 Persons Employed by Age Group, by Sex and Farm and Non-Farm Households

(in thousand persons)

	Whole country			Farm household			Non-farm household			Annual compound rates of changes in farm households (%)			Annual compound rates of changes in non-farm households (%)		
	1963	1967	1971	1963	1967	1971	1963	1967	1971	1963-1967	1967-1971	1963-1971	1963-1967	1967-1971	1963-1971
Male															
Persons employed	5,146	5,763	6,095	3,235	3,189	2,823	1,911	2,574	3,272	-0.36	-3.00	-1.69	7.73	6.18	6.95
14 - 19 years	615	604	641	447	404	389	168	200	252	-2.50	-0.94	-1.72	4.48	5,95	5.20
20 - 39 years	2,630	3,035	3,063	1,557	1,556	1,234	1,073	1,479	1,829	0.00	-5.63	-2.96	8.35	5.45	6.89
40 - 54 years	1,416	1,544	1,722	867	821	800	549	723	922	-1.35	-0.65	-1.00	7.12	6.27	6.69
55 years and over	485	580	669	364	408	400	121	172	269	2.89	-0.50	1.19	9.19	11.83	10.50
Female															
Persons employed	2,801	3,151	3,613	1,894	2,002	2,023	907	1,149	1,574	1.40	0.26	0.83	6.09	8.19	7.13
14 - 19 years	437	517	618	274	282	302	163	235	316	0.72	1.73	1.22	9.58	7.68	8.63
20 - 39 years	1,400	1,571	1,678	942	973	858	458	598	811	0.81	-3.10	-1.16	6.89	7.91	7.40
50 - 54 years	752	797	963	510	543	600	242	254	363	1.58	2.53	2.05	1.22	9.34	5.20
55 years and over	212	266	354	168	204	254	44	62	100	4.97	5.63	5.30	8.95	12.69	10.81

Source: Economic Planning Board, Annual Report on the Economically Active Population, 1971

Table 7 Persons Employed by Industry, by Sex
(in thousand persons)

	1963			1967			1971		
	Both	Male	Female	Both	Male	Female	Both	Male	Female
Total	7,947	5,146	2,801	8,914	5,763	3,151	9,708	6,095	3,613
Agriculture, forestry, hunting and fishing	5,022	3,097	1,925	4,924	2,979	1,945	4,709	2,716	1,993
-Agriculture and forestry	4,822	2,962	1,860	4,706	2,815	1,891	4,597	2,614	1,983
Mining and manufacturing	689	496	193	1,138	786	352	1,375	909	466
-Manufacturing	631	441	190	1,043	697	346	1,287	832	455
Social overhead capital and other services	2,236	1,533	683	2,852	1,998	854	3,624	2,470	1,154
	Annual compound rates of changes (percentage)								
	1967/1963			1971/1967			1971/1963		
	Both	Male	Female	Both	Male	Female	Both	Male	Female
Total	2.91	2.87	2.99	2.16	1.41	3.48	2.53	2.14	3.23
Agriculture, forestry, hunting and fishing	-0.49	-0.98	0.26	-1.12	-2.28	0.61	-0.80	-1.63	0.43
-Agriculture and forestry	-0.61	-1.26	0.41	-0.58	-1.84	1.19	0.60	-1.55	0.80
Mining and manufacturing	13.37	12.20	16.21	4.84	3.70	7.27	9.02	7.87	11.65
-Manufacturing	13.39	12.12	16.17	5.40	4.53	7.09	9.32	8.26	11.53
Social overhead capital and other services	6.27	6.85	5.74	6.17	5.44	7.82	6.22	6.14	6.78

Source: Economic Planning Board, Annual Report on the Economically Active Population, 1971

es not only resulted in rates of increment of employment exceeding those of the economically active population, but also contributed much to the increase in labour productivity.[7] Although quantitative analysis might be necessary to measure the extent to which the various factors have contributed to the increase of labour productivity during the last two decades, it may be said that such increase in labour productivity is largely attributable to importation of capital goods which have embodied advanced technology.

Improvements in workers' skills may also have added to the rise in labour productivity as they accumulate experience in the competitive system. However, one should never overlook the fact that management has been urged to focus its attention on improving labour productivity in order to survive in the increasingly challenging domestic as well as external fronts. Keen competitive behaviour in each economic unit among the same type of industry which continuously confronted by stern competition from abroad will inevitably make each economic unit more efficient. The aggressive and dynamic attitudes of the management, the workers, both skilled and unskilled, the technicians and the engineers will help to level up labour productivity and upgrade their efficiency so as to produce goods of improved quality at competitive prices. The Government has been and should continue to readjust its industrial and commercial policies so as to attain a self-propelling and self-reliant economy.

Greater increase in the demand for skilled workers will stimulate the potential labour force to improve its professional proficiency. Moreover, deiversification of industrial bases and acceleration in development of industries have boosted demand for trained technicians and engineers. The need for such professional and technical manpower will be accentuated as the country carries out industrial development schemes which will require professional services in order to make them competitive in the international market.

Rapidly increasing demand for better qualified manpower in limited supply will boost wages, and the provision of higher wages will stimulate both existing and potential workers to be highly competent in their work. In addition, the higher wages will stimulate entrepreneurs to do everything possible to increase labour productivity and, at the same time, urge them to invent more to make their industries highly competitive. This will help to make full use of human resources and, at the same time, help to improve quality of manpower. This will in turn generate the country's prime engine for economic growth.

4. Choice of Technology: Production Factor Mix

The general impression is that the Government has been tackling the problems of unemployment and underemployment with massive doses of investment and with diversification of industrial bases rather than placing emphasis on development of labour-intensive industries. The criteria which were and may still be used for choosing technology in the process of industrial development and in the course of allocating financial resources is whether a certain industry can export or directly and/or indirectly contribute to strengthening the economy so as to make it competitive on both the domestic and the international front. Capital saving may not be the criteria used for choosing technology as long as it can be manageable by the economy. As a result of implementing such policies, per capita

7) Korea Productivity Center, Index of Labour Productivity, various issues, Seoul.

income grew, but foreign debts should not be a threatening matter as long as the economy continues to be capable of increasing its net foreign exchange earnings at a sufficiently rapid pace. It turns out to be a matter of how successful the economy can be in making itself more efficient and aggressive and in tactfully adjusting to the constant changes in both internal and external economies. The focus has been centred around how to make full and most efficient utilization of the potential economic resource of the country, human capital.

In order to reveal the general trends of trade-offs between employment and capital that have resulted from carrying out such economic development strategies during the period under examination, the direct and indirect effects of export production and the development of competitive import-replacing industries on employment will be discussed. The factor intensity of direct and indirect skill requirements for production of such commodities in trade will be highlighted. No doubt there will be changes in factor intensity and skill requirements for domestic market oriented industries, but they may be inferred by studying the commodities in trade.

W. Hong has carried out a painstaking quantitative exercise in order to idendify the capital-intensity and the labour-intensity of 32 industrial sectors. Naturally, such an exercise cannot completely eliminate the built-in bias, but it may help us to draw some very broad conclusions. Estimates are made of the direct and indirect requirements of capital in terms of thousand dollars and the direct and indirect requirements of labour inputs in terms of the number of persons per $1,000 worth of outputs based on the 43 by 43 input-output table for the 1968 economy. The former is divided by the latter in order to derive direct and indirect factor intensity for one unit of output. Annual data for exports and competitive imports for the industrial sectors are compiled for the decade, 1962-1971.

Based on the aforementioned quantitative studies, the following classifications are made for the sake of convenience:

Capital-intensive industries	Labour-intensive industries
Chemical fertilizers	Non-electrical machinery
Petroleum products	Lumber and plywood
Glass and stone products	Rubber products
Basic chemicals	Miscellaneous manufacturing
Paper products	Fishery
Other chemical products	Coal
Steel products	Finished textile products
Electrical machinery	Other minerals
Fibre spinning	Leather and leather products
Printing and publishing	Beverages
Coal products	Wood products and furniture
Textile fabrics	Processed foods
Iron and steel	Tobacco
Transport equipment	Other agriculture
Non-ferrous metal products	Rice, barley and wheat
Finished metal products	Forestry

It is revealed that, in 1962, as much as 82.3 percent of exports from those industries were shared by labour-intensive industrial products. However, the figure fell to 74.4 percent in 1966 and to 71.5 percent in 1971. Although the share of exports of labour-intensive industrial products might have declined during the decade, they recorded an increase in the annual compound rate of 32.8 percent and remained large foreign exchange earners. Finished textile products, miscellaneous manufactured goods, raw products, wood products and furniture, lumber and plywood are some of the major labour-intensive industrial products which have contributed significantly to the pro-

Table 8 Exports of Selected 32 Industrial Sectors by Factor Intensity

(in million US dollars)

	1962	1966	1971
Capital-intensive industries	9.6	63.1	303.3
Labour-intensive industries	44.5	183.6	760.9
Total	54.1	246.7	1,064.2

Source: W. Hong, Factor Supply and Factor Intensity of Trade: The Case of Korea (1962-71), (Korea Development Institute, Seoul, 1963).

vision of employment for skilled and unskilled workers. It is an indication that the country has been striving to activate any labour-intensive industries which could be competitive in the international market by fully utilizing the abundantly available manpower that the country possesses. At the same time, exports of capital-intensive industrial products have been increasing at an annual compound rate of 41.2 percent during the period. Growth rates of such commodities as glass and stone products, electrical machinery, steel products, spun fibres, textile fabrics, and finished metal products are certainly impressive. The export performance of chemical fertilizers and other chemical and petroleum products are particularly worth noting as new-comers in the middle 1960s.

The country has been successful in exporting goods which used to be products of competitive and even of non-competitive import industries half a decade ago. The increased absorption of the labour force into such industries, and particularly those of higher professional training, is a result of development of such capital-intensive industries.[8] It is true that some of those modern large-scale industrial plants are built-in potential competency of local engineers, technicians and skilled workers who could handle modern large-scale industries in an efficient way and only technical assistance of short duration will be provided by foreign engineers. These potentialities will be further cultivated by experience gained by working at modern large-scale industries, and will play a crucial role in the process of developing more sophisticated industries of a diversified nature in the coming years.

During this rapid process of industrial growth, there were significant declines in imports of competitive goods, such as chemical fertilizers and petroleum products. However, imports of transportation equipment, finished metal products, electrical machinery and basic chemical goods continued to grow. The economy has been and perhaps will be persistent in developing such industries regardless of whether they are of a capital-intensive or labour-intensive nature. Rapid expansion of such import-replacing industries--with the aim of starting exports of those products in the shortest possible time--will be activated with the best possible combination of economic factors of production so as to be competitive in the international markets. This undoubtedly swell the demand for engineers, scientists, technicians, and skilled and unskilled workers to flow continuously into these productive activities.

Although there are some availability and conceptual problems in the relevant data, Hong has also attempted to estimate direct and indirect requirements for engineers, scientists, technicians, clerical workers, and skilled and semi-skilled workers for a unit increase of export products and competitive import-substituion indus-

8) It has been observed that 3 to 6 percent of the total number of employees in the recently initiated large-scale establishments are scientists and engnineers.

Table 9 Direct and Indirect Skill Requirements for Export Production and Competitive Import-replacing Production

	Engineers and scientists	Technicians	Clerical workers	Skilled workers	Semi-skilled workers	Total
Export production:						
1962	0.7	1.9	7.8	42.3	63.0	115.6
1967	2.7	8.9	46.6	125.5	221.6	
1971	6.6	20.6	128.6	327.7	549.1	1,032.8
Competitive import-replacing production:						
1962	3.0	6.4	3.8	86.0	139.1	273.4
1967	8.0	17.9	101.4	145.0	280.5	553.0
1971	12.3	28.0	159.0	331.0	558.0	1,088.5

Source: As for table 8.

ries. That exercise is carried out based on the 1968 input-output table. Similar estimates were also made for 1962-1971.[9)]

The direct and indirect requirements for engineers, scientists and technicians for export production increased at a faster rate than those of skilled and semi-skilled workers during 1962-1971. This may be attributable to the fact that the export industries have become increasingly technology-intensive and/or linked with the technology-intensive import-replacing industries developed in the country during the period. The absolute numbers of direct and indirect requirements for various categories of workers for one unit of competitive import-replacing industrial output are higher than those output for exports in 1962, and the direct and indirect demand for scientists, engineers, and technicians has also been growing at a faster rate than that for skilled and semi-skilled workers in both categories of industries during the period under investigation. It may also be that the competitive import-replacing industries have been more technology-intensive than the export industries during the same period.

It may be assumed that the share of technology-intensive industrial goods in total exports will be increased faster than that of skilled and/or labour-intensive industrial goods as the developed of competitive import-replacing industries and other new technology-intensive industries will gain greater emphasis in coming years. This will mean that the manufacturing industries development has not only been helping to increase employment but also to level up the professional competency of workers of all categories in the process of the country's economic growth.

Conclusion

The economy is not well endowed with industrial raw materials, and domestic capital and foreign exchange reserves are scarce. The capital goods producing facilities are inadequate, and basic

9) Comprehensive input-output tables for the 1970 Republic of Korea economy were made while this paper was under preparation. A quantitative exercise may be performed to supplement this study in due course.

science and technology are still backward compared with the industrially developed economies. The country has an abundant supply of human resources which may be said to be of high quality relative to most of the developing countries. The efficient utilization of those human resources available in the country was virtually ignored up to the early part of the 1960s.

The present Government shifted from defensive to aggressive economic development policies. Such policy changes urged entrepreneurs to run their economic units in the most efficient way and redirected their attention to make their firms highly competitive not only in the domestic market but also in the more challenging international markets. The Government's urge to increase exports left no alternative to entrepreneurs but to strengthen their competitiveness on a continuing basis. The Government has been successful in making the entire economy fully aware of the fact that the only way for the economy to survive is to increase efficiency in industrial activities. In other words, it has been placing top priority on the maximization of efficiency in such a way that each economic unit is to be highly competitive on both the domestic and the international front rather than encouraging any particular kind of technology to be used in the country. The choice of technology actually in use in the Republic of Korea is the outcome of the implementation of the outward-looking economic development strategy emphasizing efficiency and export promotion.

The foreign debt repayment obligations have been persistently pushing all economic activities to be highly efficient so as to make themselves capable of increasing the net foreign exchange earnings, and the Government has been providing active assistance to entrepreneurs to motivate them in every possible way to attain the national goals. The inducement of advanced technological know-how became essential as long as such technological know-how was economically beneficial and well suited to the given dynamicaly changing conditions on both the domestic and the international scene. For the purpose of attaining efficiency in economic activities, improvement of managerial skills became essential and stimulated demand for competent manpower in all the various types of occupation. This, in turn, required more professional service of a sophisticated nature and will subsequently increase the demand for highly engineers, scientists, and technicialns. That trend of development in the economy will stimulate the labour force to improve its competency, as the need for more efficient manpower in all the various skills becomes more pressing. Continuous cultivation and exploitation of human resources in the quantitative as well as the qualitative sense is synonymous with the exploitation of the potential factors of comparative advantages in the dynamic setting of the country. Those efforts together with the successful provision of inputs of other productive factors consequently resulted in a sharp increase in the exports and the attainment of the faster growing industrial structure. This, in turn, serves as the prime engine of the rapid economic growth and full utilization of human capital in the development process.

Comments on Kim's Paper - Donald M. Stracy

I think the optimism evident in Dr. Kim's paper is largely justified, although I must admit to sharing some of the doubts voiced by Prof. Yakubovsky. Dr. Kim's paper is an interesting account of the Republic of Korea's take-off in the past decade, although it is too soon yet to be able to say whether the momentum of recent years can be maintained until per capita GNP attains the level already reached in some countries which are still customarily labelled as developing countries. Much emphasis is placed on appropriate government policies, especially those operating through market-forces.

In view of the policy followed for many years in New Zealand of protecting domestic manufacturing industry by import licensing, I found the reference to the policy of requiring import-substitution industries to become competitive by international standards as soon as possible and to start exporting, of particular interest. This appears to indicate a highly desirable concern on the part of the authorities not only for the balance of payments but also for the welfare of the consumer. Such concern is not always to be found in other countries where the exploitation of the consumer by local industry is condoned by the government, with the passive or even active support of organized labour, in the mistaken belief that only by following such policies can full employment be attained or maintained.

During the five years 1966-1971 Korea's exports of industrial goods increased very rapidly, and although much of this increase was in exports of labour-intensive goods, there was also a large increase in exports of capital intensive manufactured goods. It could be instructive to seek the reasons for this, since the accepted widsom would suggest that the capital invested in capital-intensive industries could have been used to better advantage elsewhere, resulting in an even greater increase in income and employment. The assumption here of course, is that the shortage of foreign exchange is a bottleneck in development, but this certainly seems to be the case with Korea in view of the large amount of foreign borrowing undertaken.

It is mentioned in the paper that inadequate agricultural production continues to pose a problem, not least for the balance of payments. It would seem to be more meaningful to attribute this to a low increase in productivity per worker in agriculture rather than to the reduction in the farm labour force. It may be that a little less emphasis on the development of the manufacturing sector, and a little more emphasis on the development of the agricultural sector would have paid off handsomely. In this connection I would mention that New Zealand's very high productivity in pastoral farming is due in part to the ready availability of extension services based on domestic research, as well as on farm investment.

Korea's trade deficit grew from $350 million in 1963-65, to over $1,100 million in 1970-72, if I have interpreted Table 2 correctly. The servicing of the overseas debt will require about 15 percent of foreign exchange earnings in 1973, and it is estimated that in 1981 the servicing of existing debt will take almost 9 percent of foreign exchange earnings. This suggests that the balance of payments may necessitate some consolidation of the recent growth of exports and

of national income. What is relevant here is the composition of imports in recent years. If a substantial part represents imports of capital equipment, then it may be possible for exports to continue to expand at a rapid rate, but if imports have consisted mostly of raw materials, semi-finished manufactures and consumer goods then some slowing-down in the rate of growth of the economy may be inevitable, unless increased emphasis is given to the development of those industries including service industries with a low foreign exchange content.

It is also encouraging to note the importance placed by the government of Korea on family planning as an integral element of its economic and social policies. Even in developed countries a high rate of population growth whether from natural increase or from immigration severely limits efforts to raise per capita GNP. Where there is a continued high rate of natural growth f population, the resulting strain placed on a country's education system retards improvement in the quality of labour force. It is not really necessary to add that the shortage of skilled persons of all kinds is usually one of the main bottlenecks to development in less developed countries.

12

TECHNOLOGICAL CHANGE AND COMPARATIVE ADVANTAGE: AN ADVANCED COUNTRY'S VIEWPOINT

HARRY G. JOHNSON

1. Issues in the Theory of Comparative Advantage

The pure theory of international trade, as shaped by the English classical economists in response to and criticism of the mercantilist school of thought that classical economics vanquished in becoming a scientific study, is concerned with two central questions, one "positive" and one "normative." The positive question is the explanation of why international trade takes place; the normative question is the explanation of why (in contradistinction to the mercantilists' concern with the zero-sum game of increasing national power) trade is generally beneficial to both trading partners, and the conditions under which this general presumption may fail to hold. The key to both questions is the principle of comparative advantage, which in terms of the language of power can be put as the principle that, no matter whether a country is absolutely strong or absolutely weak, it can maximize the power available to it by concentrating on those activities in which it is relatively more powerful and hiring the services of specialists in those activities in which it is relatively weaker.

From the standpoint of this central general principle, it is a matter of secondary importance what the source of comparative advantage or disadvantage may be; and the classical statement and demonstration of the principle by Ricardo relied on a simple example in which Portugal's comparative advantage in wine, and England's in cloth, reflected a God-given difference in climate conditions. (It is an interesting reflection that Ricardo's example already involved what has in modern times become known as "north-south trade.") With the emergence of industrial civilization on the one hand, and of sophisticated general equilibrium economic analysis on the other, interest shifted towards the analysis of the causes of comparative advantage itself, which could no longer be regarded as a fact of nature. While the major architect of the change, Bertil Ohlin, himself had an eclectic view of the variety of reasons for which comparative advantage might differ among industrial nations, the dominant explanation, associated with the names of Ohlin and his older Swedish colleage Heckscher and more recently of Samuelson, came to be the factor-proportions explanation; that is, that differences in the relative abundance of factors of production among countries would produce differences in the sets of commodity and factor prices yielding equilibrium in countries with similar tastes in the absence of trade, and therefore systematic differences related to relative factor supply differences between the optimal production and

consumption patterns that nations would choose at a common world set of commodity prices. The explanation was made more concrete and spcific by the assumption that the factors of production in question could be identified with the post-Ricardian, broadly Marxist, division of the key factors into capital on the one hand and labour on the other (the classical Ricardian emphasis on land having been sumberged in the transition to industrial society), though it should be remarked that some of the leading theorists (e.g., Samuelson) stuck to the identification of the factors as labour and land, from either conventional respect for tradition or sophisticated awareness of the difficulties inherent in capital as a "produced" and not an "original" factor of production, or both.

The relative factor availability theory of comparative advantage, in its specification in terms of differences in relative "endowments" of capital and labour, differences in capital-to-labour ratios, or most simply differences in national wealth and affluence, seemed to make a great deal of practical sense in the understanding of what appeared to be the dominant form of international trade, particularly in the nineteenth century world economy centered on Great Britain, the exchange of exports of manufactures for imports of food and raw materials. At the same time (a point to be discussed in more detail later) it made the scientific principle of comparative advantage a focus of ideological dispute between those who regarded the existing inequality of international distribution of income and wealth as natural or at least scientifically understandable and those who regarded that inequality as unjust, offensive, and immoral. Hence the great deal of effort that has been devoted, and largely wasted, since the 1930's (and indeed by critics going all the way back to the mercantilist period) in misrepresenting the theory of comparative advantage as maintaining such obvious absurdities as that income per capita should be the same in all countries or that under no circumstances will it ever be economic for India to have a steel industry or Mexico and other less developed countries an automotive industry; and in listing all the theoretically possible cases in which market prices and costs might not correspond exactly to true social alternative opportunity costs, as if the possibility of market failure is sufficient to prove the certainty of government success.

Be that as it may, the Heckscher-Ohlin-Samuelson factor-proportions model of comparative advantage, or more accurately its crude empirical identification of factors with material capital in the form of buildings and machinery on the one hand and with labour in the form of undifferentiated human bodies on the other hand, has been sharply challenged in two major respects in the current period of scientific economic development since the second world war. The first challenge came from Leontief's empirical finding that, contrary to expectation, American imports were capital-intensive and exports labour-intensive, a finding Leontief explained by the hypothesis that American labour is much more productive than other countries' labour (he reckoned that an American worker represented three times the "labour power" of foreign workers). Subsequent research has led in a variety of directions, of which the most interesting and suggestive have been the rediscovery of "land" as a factor of production, in the specific proposition that the U.S. imports resource-intensive products domestic production of which requires the use of capital as a substitute for abundance of natural resources; elaboration of "human capital" as a component of the ostensible contribution of the time of human bodies to the production process; and the influence of the U.S. tariff in partially nullifying the comparative advantage of other countries in terms of abundance of cheap labour time and leaving the statistics of trade to be dominated by the influence of sub-categories of capital in the broad sense, including both human capital and technological superiority.

The second challenge has come from students of the micro-economic details of international trade and investment patterns among advanced countries, who have concentrated on what has come to be known as "the technology factor" in international trade and investment and whose major intellectual contribution has been "the theory of the product cycle." The technology theory was originally presented, in line with the prevailing methodology of "positive economics," empirical testing of rival hypotheses, and an "adversary procedure" in the determination of scientific truth, as a superior alternative to the factor proportions theory; but subsequent testing has shown that both theories, and some differentiated sub-species of the technology approach, have substantial explanatory power but not sufficiently commanding power to dispose conclusively of rival claimants. This is not really surprising, and in fact is a predictable consequence of the artificiality of the rival-hypothesis-testing approach. Every blind man who touches a part of the elephant learns some of the truth about it--but not the whole truth; and only the rare unfortunate is unlucky enough to be caught in generalizing about the elephant from an unrepresentative hand-hold on the tip of its tail.

2. Comparative Cost, Technology, and Development Theory

It would be an obvious mistake to assume either that models of comparative advantage are designed for the purpose of suggesting possible lines of government intervention in the operation of international competition, or that those concerned with international trade policy as a means of promoting various domestic economic policy objectives and national economic goals look to the theory of comparative advantage for inspiration in their policy thinking and recommendations. Nevertheless, theories of comparative advantage attempt to base themselves on a reasonable abstract model of contemporary production processes, the same empirical reality as concerns policy-makers and policy-prescribers, and in a very broad sense models of comparative advantage suggest ways in which trade policy may or may not be able to improve on the results of unrestricted international competition, from the national or even the cosmopolitan point of view.

Thus the Ricardian model for explaining the existence, and the nature of the gains from, international trade, based as it was on differences in comparative cost created by nature--and the unexplained differences in absolute advantage which the theory sought to dismiss as irrelevant were presumably natural in origin as well-implied a static and permanent distribution of comparative advantages and disadvantages which economic policy could do little but accept gracefully or seek to alter with the outcome only of a pointless reduction of real income and economic welfare. This view was reflected in the two major exceptions to the case for freedom of international trade allowed by classical theory; the "terms of trade" or "exploitation of monopoly power" argument for protection, which involves both a static positive analysis and a contra-cosmopolitan nationalistic concept of economic welfare; and the "infant industry" argument for protection, which as the name itself implies involves the assumption that men are everywhere the same and in adulthood equally competent.

By contrast, the Heckscher-Ohlin-Samuelson model, with the produced-means-of-production capital as the factor used co-operatively with human labour, suggests either that comparative advantages and disadvantages are determined by national differences in the willingness to accumulate capital, reflecting long-run differences in national time preferences and therefore in a fundamental sense given

by nature, or that current comparative advantage differences reflect the presence of nations for historical reasons at different stages of the process of accumulation of desired capital stocks per head, so that comparative advantage differences will change over time as the process of accumulating capital from different initial historically-given endowment positions converges on a long run equilibrium of equal capital accumulation per head (assuming similar tastes and preferences across countries). In either case there may be an argument for policy intervention to stimulate capital accumulation, in the one case if private preferences in favour of current as contrasted with future consumption or of current consumption as contrasted with wealth accumulation are judged to be socially myopic, on the other if the rate of accumulation of capital towards the long-run equilibrium level is deemed to be slower than is in the true social interest. Such policy intervention should logically be directed at incentives to capital accumulation, and not involve trade intervention as such; but trade intervention may be incorporated in the argument on the supplementary assumption that import-substitution creates more incentive for capital accumulation in import-competing industries than it destroys in exporting industries, or on a variety of arguments of the general infant-industry type to the effect that protection is necessary to teach the public the benefits of accumulating capital in industrial form.

Both the Ricardian and the Heckscher-Ohlin-Samuelson models carry the implicit assumption that involvement in international trade entails the enjoyment of economic benefits from efficient resource utilization with little or no cost in terms of serious disturbance to men's livelihood and economic and social lives--in the Ricardian model because comparative advantage is ineluctably fixed by nature, in the Heckscher-Ohlin-Samuelson model because change associated with accumulation of capital per se is likely to be slow, regular, and predictable. The case is far different with technological diffeences as a source of difference in comparative advantage, and technological change as a chronic disturber of existing patterns of comparative advantage.

Before this point can be developed further, it is necessary to observe and appreciate that "technology" as a source of comparative advantage is not, as some writers and commentators on trade and trade policy seem to believe, a free good capriciously and invidiously distributed by nature among the nations of the world. Technology is a capital good or investment good produced by the investment over time of material resources that yield their returns over further time, and (in contrast to "basic scientific research") is typically invested in by private enterprises and also by governments in the expectation that the profits will justify the costs of the investment. This basic characteristic involves an economic logic being at work in the generation of technology and its diffusion through the world economy, and if the effects of such generation and diffusion of technological knowledge on international patterns of comparative advantages as reflected in changes in comparative advantage in particular categories of traded goods, which has best been expressed in Vernon's theory of the product cycle. This logic is frequently ignored in discussions of technology in the context of international trade and economic development. On the one side there are the beliefs that "high technology" is the secret rather than the symptom of affluence, that appropriate technology can be developed without material cost, and that technological knowledge should be provided free of cost or profit margin to less developed countries by the advanced countries that bear the cost of investing in its creation. On the other side, there are the beliefs that temporary monopolists of new knowledge and their employees are entitled to charge all that the traffic will bear; and it is unfair of consumers, producers and governments in other countries to under-

mine such monopoly profits and wages by regulation of prices and competitive conditions, or by developing substitute technologies; and that it is grossly immoral for poor countries to attract technological transplants by virtue of their povery level of wage costs, and especially immoral of corporations in rich high-wage countries to respond to profit incentives to transplant technology from technology-abundant labour-scarce countries to technology-poor labour-abundant countries.

To resume the main theme of the argument, technology, unlike the natural climatic conditions of the Ricardo model, can be both moved from one location to another and accumulated or decumulated; and, unlike the material capital of the specified Heckscher-Ohlin-Samuelson model, it can be accumulated fairly rapidly on a massive scale, though (an important point) it cannot be quickly decumulated or transformed from one specific form into another.

To be more precise, the application of known technology to the development of production in new locations, particularly low labour-cost locations, can be carried out fairly quickly. This is partly because co-operant requirements of material capital equipment are not all that expensive and are obtainable through international trade in machinery and components on level terms with rival producers, while structures are largely a matter of domestic labour cost; partly because financial capital is fairly mobile internationally, particularly but by no means exclusively as a result of the development of the multinational or transnational corporation; and most fundamentally because technology by its nature is capable of being taught to and learned by large numbers of young adult human beings of little above average intelligence, almost regardless of their native culture, in training programmes of specialized types whose cost varies largely with the general level of wages and incomes in the society. (And even if the proportion of the population capable of the requisite learning is relatively small, the absolute numbers available are usually abundantly large.)

On the other hand, the decumulation and conversion of past investments in technological capital necessitated by economic change and unplanned obsolescence is expensive and socially painful, precisely because such technological knowledge is embodied in specialized form in the skills and knowledge of particular human beings. Here the relevant factors are partly biological and partly social and conventional. The biological factors are the relatively long productive life of the typical human being, a life expectancy that has been rapidly lengthened, particularly in advanced countries, by the progress of medical technology in particular and the technologies of diet and nutrition, physical self-care, and safe community living in general; and whatever biological reasons there may be for decline in the capacity to adapt and to learn new skills and habits after reaching adult maturity. The social-conventional factors, in large part anachronistic and counter-efficient, centre on the convention that a man (or woman) should choose and prepare for a particular life-time career in adolescence and early adulthood, thereafter concentrate his attention and learning activity on that career, and be rewarded by an imcome rising with advancing age in and accumulating experience of that career. The result is that successful conversion of specific "human capital" to another form is impeded more than necessary by the inflexibility of adult workers and the sharp drop in income that faces the technologically displaced worker in looking for a new skilled employment. This point is accentuated by a tendency Helen Hughes has called attention to on more than one occasion at this Conference, that while the workers in the developing countries receiving technological transplants tend to be efficient, skilled, and flexible, the workers in the developed countries suffering the international trade competition effects of tech-

nological transplants tend to be much less flexible and adaptable. This would seem to be an almost inevitable characteristic of technologial transplantation; the workers in the expanding industries in the less developed countries will tend to be "hungry" and hence efficient and anxious to stay that way, whereas the declining industries in the developed coutries will tend to be manned by workers of below average skill (and earnings) and above average age--a common characteristic of declining industries whether import-competing or not, and a reflection of the forces that make technological transplantation possible.

3. Problems of Technological Trade

Certain problems associated with involvement in technological trade, for both advanced and less developed countries, follow logically from the foregoing brief description. We deal first with the problems for developed countries.

A fundamental problem is that, to an extent that is difficult to determine, the standards of living and affluence enjoyed in the developed countries are a consequence of a temporary monopoly of superior technology (though "monopoly" is a misleading word, since the industries and firms involved are in active competition with one another), buttressed by restriction of foreign competition through tariffs and other protective techniques, and even more through restriction of immigration and hence enjoyment of the benefits of technological superiority in the form of higher wages for the advanced-country workers rather than lower prices for consumers everywhere. Standards of affluence achieved through labour scarcity and resulting high wages stand to be lost permanently through the development of production of technology-based goods in less developed countries, and this loss is accelerated by the reduction of trade barriers and, probably more important, by the technology-diffusing influence of the multinational corporation. The reason why the extent of this problem is difficult to determine is that to an important but unknown extent high wages represent, not artificial scarcity of ordinary labour supported by trade and immigration restrictions, but the necessary return on the costs of the investments in the training of skilled labour and the training of successive generations of replacements. To the extent that this is the case, technological diffusion is not a threat to the wages of labour in the advanced countries, but a factor increasing the potential gains from freedom of trade and general economic progress, as maintained by classical comparative advantage theory.

Other problems are associated with the embodiment of technology in trained human skill: to recapitulate, the longevity of the worker and his declining ability to adapt and change skill and occupation with advancing age; the reinforcement of this disability by the social conventions of the life-time career with income rising with age and experience; and the further tendency of workers in declining industries in developed countries to be less skilled and older than the average. In addition there is the general presumption that technology-intensive industries whose technology has become fairly static and which have in consequence become ripe for technological transplantation are likely to be both geographically localized and labour-intensive, and hence to have the political power to insist on governmental measures to protect their livelihoods against competition. (There may also be some probability that workers in such industries will prefer tariff and quota protection to various kinds of adjustment subsidy.)

For the developing countries, there is obviously the problem of advanced-country intervention to restrict developing-country exports

of technological products if these grow rapidly enough to cause "market disruption"; and such market-disrupting rapid growth is likely to occur as a result both of the speed with which such production can be expanded in one country and the possibility of rapid imitation and expansion of production by other developing countries. Apart from that, there is the possibility that technological comparative advantage may move rapidly from one low-wage country to another lower-wage country, raising the same problems as it does with technological competition between advanced and less developed countries. Even without such competitition among developing countries, rapid expansion of technological exports may result largely in lower prices for advanced country consumers rather than higher incomes for developing country producers. There is also the possibility, to which many commentators have recently been calling attention, that developing countries competing with one another for technological transplants, particularly by multinational corporations, may wind up paying more in terms of tax subsidies, protection, export subsidies, provision of cheap local capital, and guarantees on the repatriation of earnings and original capital investment, than the benefits that the presence of production using advanced technology bestows on the economy in the way of higher wages, development of labour skills, and training of domestic managerial talent.

Finally, there are problems resulting from the facility with which a magical faith in technology, on the part of both private engineers and public servants, politicians and the electorate, can be transformed into new and plausible versions of two old arguments for protection. One is the "national defence" or "self-sufficiency" argument, which lends itself particularly to government protection --especially in the sophisticated form of modernization subsidies and subsidization of scientific research and development--of "high technology" industries in the advanced countries. The other is the "infant industry" argument, particularly appealing to less developed countries hoping to transcend the limitations of their limited stocks of material capital and human engineering skills by "leaping stages" in the slow process of growth of affluence in western economic history, through selective protection of a few high-technology industries. With the latter argument in particular, there is the usual problem of drawing the line between wisely accelerating the natural economic tendencies towards development of low-wage regions and foolishly squandering resources on developments that will be profitable only when general affluence and educational levels have been raised sufficiently.

4. Problems of International Trade Policy in a Technological World

The list of problems of international trade policy on the agenda of the current "Nixon round" of G.A.T.T. negotiations for trade liberalization is formidably long and contains some extremely thorny items. The notoriously most difficult are trade in agricultural products, especially temperate zone cereals and related products, the problem of so-called "non-tariff barriers to trade" and the problems of adjustment assistance and the prevention of "market disruption." Agricultural trade problems will not be dealt with here, though it should be remarked that the essential problems are fundamentally technological in origin. The resort to agricultural protectionism in modern times (approximately since World War I) was the combined result of improvements in the technology of land transport that opened up vast new areas of fertile land and sea transport that made their output available to and relatively cheaper than domestic production for the European market, and of military concepts and technologies that made agricultural self-sufficiency and the

availability of large numbers of potential peasant-soldiers desirable in the interests of national self-defence. More recently, the problem of domestic agricultural poverty suggesting protection as a policy solution is closely associated with the interaction of rapid labor-saving technical progress in agriculture and low income and price elasticities of demand for foodstuffs and cropped raw materials. Most recently, the trade problems potentially associated with the "green revolution" are, as the name itself suggests, the consequence of improvements in agricultural technology in the hotter regions of the world; and the potentialities of such improvements are barely beginning to be realized in large-scale application.

The other two problems are also more or less closely associated with technology as a factor in determining national comparative advantages and shifts in them over time. The problems of adjustment assistance and the avoidance of market disruption are obviously directly consequential on the development of new technologies, their diffusion in response to differences in labor cost levels (and also the growth of markets with affluence), and their effects in rendering existing technologies or the existing locations of production using recently-developed technologies obsolete. But most of the problems grouped under the general heading of "non-tariff barriers to trade" are also associated more or less directly either with technology itself, or with the variety and complexity of ways in which governments can attempt to promote the use of technology by domestic producers and protect such producers from the competition of foreign users of rival or the same technologies. Thus health and safety regulations of product characteristics, and trade marking and labeling of products, are genuinely or ostensibly prompted by the desire to protect consumers against potentially dangerous side-effects of technologically complex products, or to inform them of the use of ingredients that they cannot detect or ascertain for themselves. Preferential governmental purchasing policies may be motivated by protectionist objectives or by problems of assessing technological performance characteristics and having adequate recourse against suppliers whose products may have unsuspected technological weaknesses or injurious side effects. "Regional development policy" may involve either covert protection of obsolete or emergent technologies, or an unobjectionable desire to raise the technological level of the region and its population to the national standard.

For the purposes of broad discussion, the international trade policy problems associated with technology as a determinant of comparative advantage may be divided into two groups: those associated primarily with trade in technologically advanced products among advanced countries, and those associated with trade between advanced and less developed countries based on the diffusion of technology to the latter in consequence of their lower levels of wage costs.

As regards trade among advanced countries, the general principle that should guide judgment is the classical policy implication of comparative advantage theory, namely that (with the exception of the pursuit of import-restricting policies by countries that may be relatively large enough in world trade for such policies to improve their terms of trade at the expense of foreign producers and consumers--an exception which incidentally can be taken as inapplicable to the policies of less-developed countries, though often wishfully assumed to apply) improt restriction has its main effect in reducing the economic welfare of the consumers of the country practicing it, and (the classic analysis of "dumping") export subsidization has its main effect in increasing the welfare of foreign consumers at the expense of the domestic taxpayers who pay the cost

of the subsidy, provided that dumping is not used temporarily only, as a device for bankrupting foreign producers in order to clear the way for establishment of a monopoly by the domestic exporters. (It should be noted that this last proviso, like some other blanket concessions of classical theory to the protectionists such as the "infant industry" argument for protection and the argument for the tariff as a bargaining weapon, requires more careful examination with the aid of modern trade and value theory than it has yet received. Specifically, both the welfare-theoretical necessity of time-discounting in assessing the net welfare effects of time-separated costs and benefits, and the industrial organization concept of potential entry as a restraint on the exercise of monopoly power, need to be brought into a sophisticated analysis of monopoly-motivated temporary dumping, just as time-discounting of future potential benefits for comparison with current costs, and the possible erosion of potential gains through substitutions acting over time, need to be brought into the analysis of the "barganing tariff.")

Apart from "optimum tariff" ("terms-of-trade") possibilities, the main source of damage to other countries' economic welfare by a particular country's commercial and related policies is associated, not with the policies themselves, but with the possibility of unexpected significantly large-scale changes in those policies,disruptive of market opportunities on the expectation of which other countries have made specialized investments of material, human, and technological capital. Avoidance of such disruptions requires, first and foremost, an international monetary system proof against seriously deflationary developments that give countries strong inducements to preserve domestic employment at the expense of employment in foreign countries, through intensification of import restriction and resort to export subsidization. (Inflationary international monetary developments, while in many ways comparably disruptive of expectations and trading and investment patterns based on them, have tended to have the beneficial effect in recent years of inducing countries to reduce their import barriers and their export subsidies.) Second, it requires international agreements restricting the ability of countries to use import protection and export promotion as means of staving off the adjustments of industrial structure required by world economic change and evolution. The proper solution, in general terms, is to work as closely as possible to the establishment of complete freedom of trade, this being the system of guarantee easiest to specify and enforce. But this in turn requires the development of legitimate policies, alternative to protection for coping with the adverse effects and strains of economic change on national economic structures mediated through changing international trading patterns consequential on changes in comparative advantage and disadvantage.

This problem is particularly acute in the context of changing trade patterns between advanced and developing countries, reflecting the diffusion of technology in response to differences in general levels of wage costs. Here, discussion of the problem of alternatives to special protection for production and labor in advanced countries threatened by rising competition from the transfer of technology to lower-labor-cost production in the developing countries has given rise to the two concepts of "adjustment assistance" and "safeguards against market disruption." Three points are worth making in connection with these concepts.

First, from the standpoint of the advanced countries, adjustment assistance should be considered in the general context of economic change and adjustment to it, rather than the specific context of change mediated through changes in international trade (both imports and exports) and the still more specific context of increasing competition from imports. The basic fact is that the general

philosophy of competition and free enterprise (though it has been evolving rapidly in recent years) still rests on an assumption of slow and gradual change which the entrepreneur and his workers should be able to recognize in good time and to which they should be expected to adjust with their own resources--with the sole important exception of change due to the evil machinations of unprincipled foreigners, against whose malevolent activities the nation should protect its innocent and worthy workers and businessmen by exercise of its sovereignty in commercial policy. That assumption needs to be replaced by the recognition that in a world of fairly rapid technical change, which may be generated and in fact is most usually generated by domestic rather than by foreign developers and appliers of such technology, no one can be reasonably expected beyond rather narrow time and space limits to forecast technical change and its consequences at all accurately, and that society as a whole has a general obligation to adopt and implement policies for minimizing the individual damage, and maximizing the individual exploitation of opportunities, resulting from technical change that is agreed to be of beneficiality to the community as a whole. This obligation is particularly incumbent on society in the case of technology embodied in specialized skilled labor, owing to the longevity of embodied human capital and the limited stock of knowledge that the individual worker has the material and mental resources to collect and analyze.

Second, again from the standpoint of the advanced countries, adjustment assistance and safeguards against market disruption need to be considered as complementary and not as substitute policies. Adjustment assistance is designed to increase the speed with which change can be absorbed and digested; safeguards against market disruption are designed to slow down the speed of the change that has to be absorbed and digested. Optimum policy with respect to change assciated with shifting comparative advantage in response to the development and diffusion of technology requires joint optimization with respect to both types of policy, not prior choice of one line or other of policy and subsequent optimization with respect to it alone. Both policies also require drawing a fine line between optimal pacing of change and protectionist resistance to change, a line which is probably significantly easier to draw and maintain where the two policies are considered jointly than when the full weight of responsibility for controlling the rate of change and absorption of it is placed on one type of policy only.

Finally, with reference now to the developing countries, it must be recognized that they have an interest in optimization of the rate of change and absorption of it by the developed countries, which is not simply reducible to maximizing the rate of expansion of their exports that the developed countries can be obliged to accept and adjust to as best they can. There is a real problem of adjustment to and optimal control of the diffusion of technology and its results in changing patterns of comparative advantage, whose solution will not be facilitated by blind insistence that the principle of free trade and maximum efficiency in the use of world resources implies unrestricted access for developing countries to the markets of the advanced countries and unlimited obligation of the developed countries to tolerate and shoulder the costs of whatever economic disruption and social distress may be involved for their citizens. Quite apart from the strong probability that such an attitude will dispel goodwill in the developed countries towards the less developed, and so provide support to protectionist and export opportunity-restricting policies in the developed countries, its implementation in trade policy arrangements might well be adverse to the trading interests of the less developed countries themselves. It has been a long-standing contention in the political-economy theory of the development problem, especially among Latin American economists,

that freedom of trade is unfair as between developed and less developed countries because its effect is to raise labor incomes in the developed country exporters and to keep labor incomes unchanged, by lowering export prices, in the developing countries. The grain of truth in this contention is that competition within and between less developed countries with surplus or elastic populations tends to drive prices down to subsistence, on classical unlimited-labor-supply lines; and this is likely to be the result of unlimited competitive expansion of exports made initially highly profitable by the diffusion of technology to and among the developing countries. The fundamental solution to this problem obviously lies in the control of population growth in the less developed countries, pending ultimate arrival of the stage of development at which procreation is controlled by voluntary choice of the number of children the parents can afford to feed, house, and educate to their own or better standards of productive contribution. In the meantime, control over the speed of development of trade based on technological diffusion may, intentionally or unintentionally, have the effect of contributing more to the raising of living standards and the strengthening of automatic economic pressures for development than cutthroat competition among developing countries in exporting technologically advanced products to the developed countries.

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THE ROLE OF TECHNOLOGY TRANSFER IN PACIFIC ECONOMIC DEVELOPMENT: A SUMMING-UP

HEINZ W. ARNDT

Just as we recognise in Professor Kojima the father figure of the continuing series of Pacific Trade and Development Conferences, so we must clearly acknowledge Professor Miguel S. Wionczek as the progenitor of this Sixth Conference. It was he who some years ago reminded the PAFTA group that several Latin American countries border on the Pacific; he persuaded President Echeverria to give his official blessing and support to an invitation by Mexico to host the conference; and last but not least, he chose the theme: "The Role of Technology Transfer in Pacific Economic Development". Let me begin this summing up by expressing our debt to Miguel Wionczek, good economist and good friend.

It is doubtful whether transfer of technology would have been chosen as the theme for such a conference ten years ago, or whether it would have been chosen even this year had the host been one of the Asian countries. The growing importance attached to the international transfer of technology in thinking about economic development largely reflects the shift of emphasis from physical and financial capital to human capital--technological and other knowledge, skills and attitudes--as factors in economic growth. It also reflects increasing concern about the costs, economic and non-economic, of the main, or at least the most conspicuous, channel for the transfer of technology from developed to developing countries, the multinational corporations. If capital were still regarded as of primary importance, direct investment could be replaced by borrowing. It is because of the importance attached to the element of technological and managerial know-how in the direct investment package that the problem of "untying the package", of seeking ways of securing the know-how without direct investment, has begun to loom so large. And nowhere larger than in Latin America.

This, too, is not hard to explain. The obvious, and probably sufficient, explanation is the enormous shadow cast over Latin America by the United States, the overwhelming preponderance of the US-based multinational corporation. Other parts of the less developed world (and even advanced countries in Europe and Oceania) are worried about foreign ownership and control, but their anxiety has not reached the almost obsessive degree one notices in Latin America, precisely because direct investment capital has come to those regions from a greater variety of countries. The theme of the conference, therefore, has been a most particularly Latin American one.

In his welcoming address, Miguel Wionczek said to the foreign participants: "We would like you to see this problem from our point

of view". Speaking as one of the foreign participants, I can assure him that the three days of discussion have very greatly helped us to do so. I am sure all of us go away with a much better understanding of the reasons for Latin American concern. May I add that we also leave deeply impressed by the intellectual ability and integrity of the Mexican contributors to the discussion, even when we did not entirely see eye to eye with them, and by the vigorous effort of research and policy experimentation that is being put into this problem area in this and other Latin American countries.

There is still a serious dearth of empirical knowledge about the mechanisms of transfer of technology, about the costs of alternative mechanisms, about their effectiveness and about the operation of alternative regulatory policies. Miguel Wionczek mentioned in one of his statements his regret that among the papers there were not more case studies. I share this regret. Apart from the paper by Dr. Tabe which, however interesting, dealt with a relatively remote case, we were tantalised by glimpses of empirical work, especially Dr. Giral's fascinating insights into the inner workings of the chemical industry. If only we could have had a paper by him, and one by Dr. Campos on the data being accumulated through registration of licensing agreements.

The conference Agenda divided the subject into four "themes": 1. The context of international relations in the Pacific region as it affects development, trade and technology, 2. International trade in technology, 3. Intra-national diffusion of technology, and 4. Technology and comparative advantage in trade. I will say little in this summary about the first and last. The first gave the four authors generous scope of which they freely availed themselves. Dr. Martinez Legorreta sounded some of the keynotes of the Latin American point of view: the threat of the multinational corporations, often supported by the US Government, to the sovereignty of Latin American countries; regional integration as a counter to "dependence"; and the need to turn for new sources of technology to the socialist countries. The two papers by the two participants from the Soviet Union whom everyone was happy to welcome for the first time to a PAFTA conference exuded a genial optimism about the prospects for economic development and co-operation in the Pacific. Professor Ranis focused his statement of a North American point of view on the interesting and persuasive hypothesis that resource-poor countries in Asia have accomplished the transition from the import-substitution to the export-oriented phase of industrialisation more easily and effectively than those whose more ample resource endowment has allowed them to delay the painful adjustment, with possibly serious consequences not only in the form of slower growth but also less equitable distribution. Dr. Okita's paper gave an account of Japan's experience in the acquisition and adaptation of technology which left at least one listener as mystified as ever about the social and political conditions which made possible in Japan what seems so heartbreakingly difficult, if not impossible, everywhere else.

Professor Harry Johnson, in the penultimate session, showed, with his usual analytical brilliance, where and how technology transfer fits into the theory of comparative advantage, but his policy recommendations related more to the problems of structural adjustment which were the theme of the last conference than to those aspects of technology policy of greatest interest to the Latin American participants.

The main discussion of these aspects took place in relation to the second and third "themes", especially in and on the excellent and comprehensive papers by Drs. Helleiner and Thedim Lobo, though the distinction drawn by the organisers between "international trade" and "intra-national diffusion" of technology got lost in the process.

I propose, therefore, to divide the issues broadly into positive and normative, in other words, those to do with description and analysis and those to do with policy.

Issues--Descriptive and Analytical

Quite early on there was general agreement that the title of the conference was something of a misnomer and that the slant which has been lent to most recent discussion of the subject by its connection with the multinational ogre may be somewhat misleading. What the less developed countries need is not so much transfer of the high technology of the industrially advanced countries, but adaptation, or better still, as Helen Hughes emphasised, a widening of the spectrum of technologies available and in use in the industrial sector of developing countries. The emphasis in recent discussion has been on "captive" technology, technical know-how which is subject to patents or otherwise the property of (usually, though not necessarily, private) enterprises, and more particularly technical know-how in manufacturing industry. The suggestion in one of the Latin American papers that this captive knowledge is "more important for economic development" than all other knowledge and skills was withdrawn by the author under challenge, but it was generally agreed that it is this captive knowledge that presents the most difficult problems, precisely because it is not freely available but has to be purchased at often considerable cost. Professor Kojima raised the interesting question why the problem of captive technology which is so serious in manufacturing does not arise in agriculture (though one participant mentioned omimous recent signs of trade marks covering chicken raising and such); here, most new technology, as the striking examples of the high-yielding varieties of wheat and rice show, is made freely available to all countries, and this would also seem to be the case in most service industries. But the question was not taken up. Clearly, although it may be true, as Professor Johnson emphasised, that all knowledge costs something to produce, it is not the case that all knowledge, even all economically valuable technology, is sold at a price. The reasons might be worth closer examination.

As far as most industrial technology is concerned, the cost of acquiring it in one way or the other is inescapable. The question for the developing countries is how the costs might be minimised. The peculiarity of direct investment as the mechanism of transfer is that it combines, in one package, not merely capital and entrepreneurship but also various kinds of know-how, including not only the technical innovation which may be patented but also the technology embodied in capital equipment, the engineering knowledge and experience needed to instal, service and maintain the equipment and to adapt both machinery and process, the managerial knowledge and experience needed to operate the plant efficiently, recruit, train and supervise the workforce and market the product, and finally the international contacts which give access to finance and export markets. The main objections to direct investment as the mechanism of transfer are that the technology imported by multinational corporations is frequently inappropriate, that the direct financial cost of technology thus obtained is often very high (though in the nature of the direct investment package, particularly where transfer occurs through internal transactions between head offices and branches or subsidiaries, the cost can usually not be identified), that multinational corporations do little to transmit knowledge to the nationals of the host country and may indeed inhibit local research and development, and that in extreme cases extensive foreign ownership and control of a developing country's industries undermine a country's national autonomy and identity. Most of this was familiar ground, but Dr.

Helleiner developed the first objection by analysing in some detail the distinction between production and consumption technology. He suggested that it is particularly in relation to the latter that the net benefits to the less developed host country of the operations of multinational corporations are liable to be negative, but agreed that it was one thing to protect consumers from pointless product differentiation and mendacious advertising--though even here there is no easy remedy since fiscal discouragement of advertising needs to be accompanied by an acceptable alternative source of finance of news media--and quite another for Big Brother to lay down what range of goods and services consumers may have.

The most obvious alternative means of acquiring foreign technology is by the purchase of patents or trademarks or by licensing contracts. The general view among Latin American participants was that these methods also tend to impose excessive costs on the developing countries. While few seriously advanced the extreme view that all knowledge should be free, there was said to be much evidence of exploitation of purchasers in less developed countries by owners of such industrial property because of the weaker bargaining power and inadequate information at the disposal of the former, and of the use of patents and trademarks for the exploitation of consumers through product differentiation and oligopolistic pricing.

A third mechanism of international transfer of technology, through import of capital goods, was the subject of two papers, but niether addressed itself to this aspect. The paper by Dr. Singh was devoted primarily to arguing the case for an industrial policy of import substitution in relation to capital goods, and incidentally led Helen Hughes to suggest that the import bill for capital goods could be greatly reduced in most LDCs by more effective utilisation of the existing capital stock and by adoption of less capital-intensive methods. Dr. Fajnzylber reported on a study of international trade in capital goods which yielded the interesting conclusion that supply is becoming more competitive, with possibly beneficial effects for the less developed countries, but the study was not designed to throw light on imports of capital equipment as a means of transfer of technology.

One paper discussed international transmission of "diffuse" rather than "captive" knowledge, through official technical assistance. While highly and probably unduly critical of most past efforts by national and international agencies to assist developing countries through technical assistance, mainly on the ground that this effort has too rarely succeeded in building up self-sustaining institutions and technological capability in the host countries, it was valuable in stressing that "captive" knowledge, however acquired, is not enough without a wide range of other knowledge and skills.

Issues of Policy

The discussion of policy ranged so widely that any summary must be highly selective and inevitably somewhat arbitrary. Let me begin by mentioning two notions, each clearly attractive to many in the Third World and each in my view a will-o'-the-wisp. The first is the example of Japan. The fact that Japan achieved her status as one of the world's most advanced industrial countries without until quite recently admitting any direct investment capital inevitably raises the question in many Latin American minds: "Why cannot we do this too?" Why not buy foreign technology, as Japan did, without surrendering ownership of any part of the domestic economy to foreigners? The paper by Dr. Okita gave some of the answers, and participants in discussion added others. Japan, even 100 years ago, possessed many prerequisites for development with which most

less developed countries to-day are still ill-endowed: an efficient central and local government administration, an actual or potential entrepreneurial class, a high degree of social cohesion and discipline, and a relatively high level of mass education. On this basis, Japanese government over a century pursued a determined policy which for long gave priority to improvements in general and technical education, infrastructure and productivity in agriculture. Even so, it took Japan 100 years to catch up, and one knowledgeable observer questioned whether Japan might not have obtained foreign technology at lower cost had she liberalised her policy on direct investment sooner.

The other notion is that the less developed countries should seek new technology in the socialist countries. Dr. Yakubovsky referred in his paper to technical assistance and training provided by the Soviet Union to India and Sri Lanka in connection with various industrial projects, but these did not seem to differ in any material respect from similar projects and technical assistance supplied to LDCs by western countries. He also stated that the Soviet Union has never refused a request for technological know-how by a less developed country and never will. I have no knowledge which would enable me to challenge this statement. But I confess I remain sceptical. Are we really to believe that there is no technical know-how, no blueprint, which the Soviet Union would not readily hand to any other country, free of charge?

At a more realistic level, five main lines of approach to the problem could be distinguished among the welter of written and oral suggestions. To list them--from right to left as it were--they were: 1. Correction of faulty domestic policies which contribute to the high cost of foreign technology, 2. Improvement of local knowledge of the international market for technology, 3. Upgrading of engineering and other skills needed to make the best of importeed technology, 4. Government regulation of various kinds, and 5. International agreement.

1. Examples under the first heading were protectionist policies which enabled multinational companies to earn monopoly profits, unnecessarily generous tax and other incentives to attract foreign investment, and other distortions of relative prices.

2. If a major source of excess costs was the weak bargaining situation of local purchasers of technology due to their ignorance of the market, much could be done by improved information. Companies could not be forced to give up trade secrets, but, as Dr. Campos explained in a most interesting account of the new Mexican system of registration of all licensing agreements, it should be possible to give local firms much information about alternative foreign sources of supply of technology and of the terms and conditions on which it is available.

3. Upgrading of local engineering and other necessary skills is a long-term task about which volumes could be and have been written. Dr. Giral, in a few trenchant setences, complained that "we force our Governments to apply restrictive measures instead of raising the level of education and practical training of our factory workers, farmers, fishermen, all the people who need to assimilate and adapt and apply new technology, not merely know-how, but know-what, know-where, know-why".

4. A large proportion of the papers by Latin American participants, and many contributions to the discussion, were firm in recommending government control or operation of enterprises as the only solution to the problem, preferably as part of "coordinated national planning in the national interest". Such general professions of faith reminded one of Professor Johnson's reference to the practice

of "listing all the theoretically possible cases in which market prices and costs might not correspond exactly to true social alternative opportunity costs, as if the possibility of market failure is sufficient to prove the certainty of government success". But there were also more specific and realistic proposals. Mention has already been made of the Mexican system for registration of licensing agreements. Dr. Salgado reported on the new policy package adopted by the Andean Group, including requirements for the gradual transfer of a majority share of the equity of foreign-owned enterprises to local owners, limitation of the legal rights of owners of industrial patents, and a technology policy some parts of which are beginning to be carried out.

The most comprehensive set of proposals was put to the conference in the paper by the Brazilian expert, Dr. Thedim Lobo, who was unfortunately unable to be present. His list of objectives for a policy for the transfer of technology in developing countries was quoted by Miguel Wionczek and, although it provoked Professor Johnson into sharp and not unjustified criticism for being too vague and insufficiently grounded in economic analysis, it seems to me worth quoting again in this summary; for, better than anything else I have seen, it indicates the trend of thinking among informed Latin American opinion on the subject:

1. To be compatible with the goals set forth in the industrial development policy, as well as in national plans for economic development and scientific and technological progress.
2. To import technology, rather than importing capital or goods.
3. To buy technology, rather than leasing it.
4. To remove obstacles to the absorption and domestic diffusion of technology, through measures aimed at eliminating explicit or implicit restrictions embodied in transfer agreements.
5. To appraise the know-how to be imported.
6. To strengthen the competitive and bargaining powers of domestic enterprises, offsetting their disadvantages vis-a-vis foreign enterprises.
7. To reduce the costs of importing technology.
8. To support technological progress in domestic firms.
9. To support the development of national engineering firms, as well as technical and economic consultants.
10. To support the development of research centers.
11. To promote exports, especially of manufactured goods.
12. To provide a better knowledge of alternative sources for the supply technology.
13. To prevent know-how payments from turning into a form of remunerating capital not subject to risk.
14. To allow only in special cases the payment of know-how on a percentage basis, always establishing a ceiling for such payments.
15. To prevent know-how from becoming a patent of unlimited duration.
16. To engage foreign enterprises in domestic efforts for scientific and technological development.
17. To avoid impairing the inflow of external savings and the transfer of needed technology.

When, however, Dr. Lobo in his paper proceeded to outline the "institutional machinery" he envisaged for implementing such a policy, many participants felt compelled to part company. An Industrial and Commercial Development Council, operating at inter-ministerial level, as well as through an Executive Secretariat with wide-ranging functions and through "specific bodies charged with" such tasks, among many others, as control of tariffs, control of imports, control of foreign investments, promotion of external trade and "the screening, negotiation and registration of technological contracts and the granting of patents and trademarks", seems ideally designed to bring almost any development process to a grinding halt.

5. Finally, reference was made to efforts under way in various international fora to promote reform of the present system of transfer of technology in various ways, including a Code of Conduct a draft of which, recently prepared by a Working Group of the Pugwash Conference on Science and World Affairs under Professor Wionczek's chairmanship, was tabled at the conference. The spirit in which this task is being approached is also well reflected in the relevant section of the draft of the Charter of Economic Rights and Duties of Sates adopted by a recent meeting, held in Mexico, of an UNCTAD Working Group on that Charter:

> Every State has the right to benefit from the advances and developments in science and technology for the acceleration of its economic and social development.
>
> All States should promote international scientific and technological co-operation and the transfer of technology, with proper regard for all legitimate interests including inter alia, the rights and duties of holders, suppliers and recipients of technology. In particular, all States should facilitate: the access of developing countries to the achievements of modern science and technology, the transfer of technology and the creation of indigenous technology for the benefit of the developing countries in forms and in accordance with procedures which are suited to their economies and their needs.
>
> Accordingly, developed countries should co-operate with the developing countries in the establishment, strengthening and development of their scientific and technological infrastructures, and their scientific research and technological activities so as to help to expand and transform the economies of developing countries.
>
> All States should co-operate in exploring with a view to evolving further internationally accepted guidelines or regulations for the transfer of technology taking fully into account the interests of developing countries.

Conclusion

Having deliberately confined the body of this summary to the many practical, down-to-earth issues which were discussed at the conference, I would fail in my duty as a reporter if I did not mention in conclusion some of the broader, more ideological, differences which coloured much of the debate and which, it would not be unfair to say, tended with some exceptions to range the Latin American and Soviet participants on one side and the other foreign--North American, Asian and Australasian--participants on the other.

Sometimes it sounded like old-fashioned "socialism vs capitalism". More often it was expressed in terms of a conflict between a "market-oriented" and a "state-control" approach. There were charges from the one side that the other believed it could "leave everything to the market" and pained protests that the intention was rather to have government use the market as an instrument of national policy. There were charges from the other side that the one side wanted to control everything and pained protests that the intention was merely government regulation of the sort which is all-pervasive in the US economy. Clearly, there were real differences of emphasis, just as there were real differences of opinion about the degree to which multinational corporations were subject to market pressures or manipulators of the market.

More significant, perhaps, were the differences between the two groups in their views--feelings is the better word--about the future,

and on this issue the two Soviet participants were clearly ranged with the other foreigners, indeed I doubt whether any of the latter saw the prospects in quite such rosy hues. I confess I was distressed and surprised, as a visitor to Latin America, to encounter so much bitterness, almost desperation, among our Latin American colleagues. One does not often hear eminent, sober academics use the language of international confrontation, about their countries "running out of patience", condemning "mere tinkering with the rules of the game", rejoicing that the enemy has been found "much more vulnerable because of dependence on supply of raw materials" and warning that "the beginning of a transfer of economic power from developed to certain less developed countries" is at hand.

There is so much more poverty in Asia than in Latin America, certainly, as far as I can judge, than in Mexico; there is so much evidence of achievement in economic development in Mexico, as in Brazil; Mexico seems to have so much more of the natural resources, material and human capital for further development than many Asian countries, that the visitor finds it hard to account for the prevailing sense of failure and impotence. When one reads of all the intolerable burdens which, according to our Latin American friends, weigh down the latecomers in industrial development, and of the insuperable obstacles in their way, one would not believe that Japan, Sweden or Australia could ever have made it.

I hope these last remarks will not suggest that I have quite failed to see the problem from the Latin American point of view. I think we foreign visitors have all learned a great deal, but we may be forgiven for wishing that, just occasionally, as for Dr. Samuel Johnson's amateur philosopher, "cheerfulness" would "break in".

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